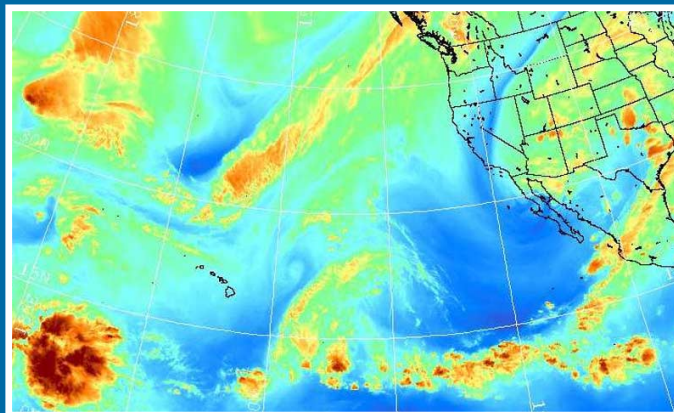
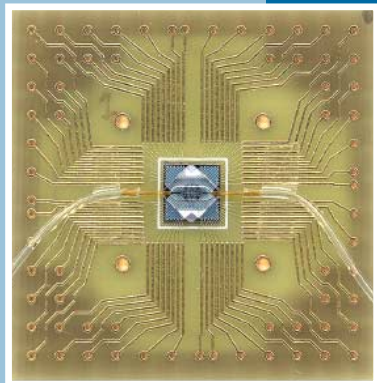


# Technology Transfer

Naval Research Laboratory



FY00

## Technology Transfer Annual Report

prepared by

Technology Transfer Office

October 2000

Many of the Naval Research Laboratory's (NRL's) technologies have commercial applications in addition to the defense-oriented objectives for which they were originally developed. NRL developments in areas such as radar, radio, satellite navigation, software, fiber optics, chemical and biological sensors, and a wide variety of materials and coatings have made significant contributions to the safety and welfare of the civilian community. The transitioning of NRL's dual-use technologies to the private sector is facilitated by NRL's Technology Transfer Office. This office implements the Technology Transfer Act by which Congress authorized Federal laboratories such as NRL to participate in Cooperative Research and Development Agreements (CRADAs) and patent licensing agreements. In the last ten years, NRL has entered into more than 200 CRADAs with industry, universities, nonprofit organizations and other government organizations. In addition, NRL has executed over 40 licenses to its inventions.

This report describes the history of Technology Transfer at NRL, summarizes NRL's Technology Transfer initiatives in FY00, and describes trends in NRL Technology Transfer. During FY00, NRL signed CRADAs on topics that range from fundamental investigations with long-term prospects for commercialization to projects that involved the implementation of mature technology developed for defense use into commercial systems.

Among DoD laboratories, NRL is a recognized leader in the area of Technology Transfer. In FY00, NRL inventors Dr. Robert Brady of the Chemistry Division and Mr. Larry Kraft formerly of the Chemistry Division, were presented with the Vice Admiral Harold G. Bowen Award in recognition of the importance of their technology transfer to the operational Navy. The Bowen Award is named in honor of the first Chief of Naval Research and recognizes patented inventions of present or past Navy employees that have had a significant impact on the operation of the Navy. Dr. Brady and Mr. Kraft invented a nonskid coating formulation that provides traction and directional control to men and machinery operating on decks of aircraft carriers, amphibious assault ships ("helicopter carriers") and air-capable ships.

NRL is proud of its record of Technology Transfer. NRL's Technology Transfer Office welcomes inquiries from across the NRL community and the private sector regarding how we can work together to transition NRL's leading edge technological developments into the next generation of products and services for the public.

Catherine M. Cotell, Ph.D.  
Head, Technology Transfer Office

Further information is available from

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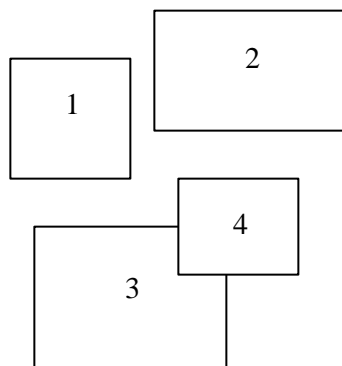
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1. Bead Array Counter (BARC). A multianalyte biosensor on a chip based on technology developed in the Chemistry Division and licensed to Graviton, Inc.
2. Water vapor map obtained by NRL-Monterey Marine Meteorology Division. Satellite meteorological application software developed by NRL is being integrated under a CRADA into SeaScape Corporation's TeraScan software package.
- 3 & 4. University of Texas ambulance used under a CRADA to demonstrate transmission of medical data from a remote location to a hospital trauma center using NRL satellite communication technology.



**U.S. Naval Research Laboratory  
Technology Transfer Office  
Annual Report FY00**

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REVIEWED AND APPROVED  
NRL/PU/1004-0-428  
NOVEMBER 2000

T. Coffey  
Director of Research  
Naval Research Laboratory

Approved for public release; distribution is unlimited.



## OVERVIEW OF TECHNOLOGY TRANSFER AT NRL

### Objectives

The objectives of the Technology Transfer Office at the Naval Research Laboratory (NRL) are to

- create alliances with industry and academia that will enhance and support the mission of the Laboratory; and
- facilitate the implementation of NRL's innovative technologies in products and services to benefit the public.

### History of Technology Transfer at NRL

The following figures illustrate the history of the Cooperative Research and Development Agreement (CRADA) and patent license agreement (PLA) programs at NRL. Figures 1 and 2 show the number of CRADAs and CRADA amendments and the associated income to NRL from 1989–2000.

Figure 3 shows the distribution of active CRADAs by NRL division number. Figure 4 shows the distribution of income to NRL associated with all CRADAs that were active during FY00 by NRL division number. It should be noted that in Figure 3 and the subsequent figures in this report in which

data are broken down by division number, CRADAs from the disbanded Code 6600 are reported under the division number to which the NRL CRADA Program Manager was reassigned. NRL divisions are identified by their Code number in Appendix A.

Figures 5 and 6 show the number of PLAs and the royalty income from PLAs from 1993–2000.

Figure 7 shows a breakdown of NRL's active licenses into the following categories: materials, sensors, electronics, fiber optics, coatings, and software. Materials and sensor technologies represent the majority of NRL's active licenses. Based on the licenses under negotiation at present, it is anticipated that the number of licenses to software patents will increase in the coming years. Likewise, the number of licenses to fiber optic devices that are not sensors is also expected to grow.

Among the goals of the legislation (e.g., the Bayh-Dole Act of 1980, the Small Business Innovation Development Act of 1982, the Small Business Technology Transfer Act of 1992, and several Defense Authorization Acts) authorizing Federal Laboratories to participate in technology transfers is to enhance and support small business ventures. As shown in Figures 8 and 9, a large fraction of NRL's active CRADAs and PLAs are with small businesses. A further goal of the legislation governing technology transfer at Federal laboratories (e.g., the Bayh-Dole Act of 1980, the

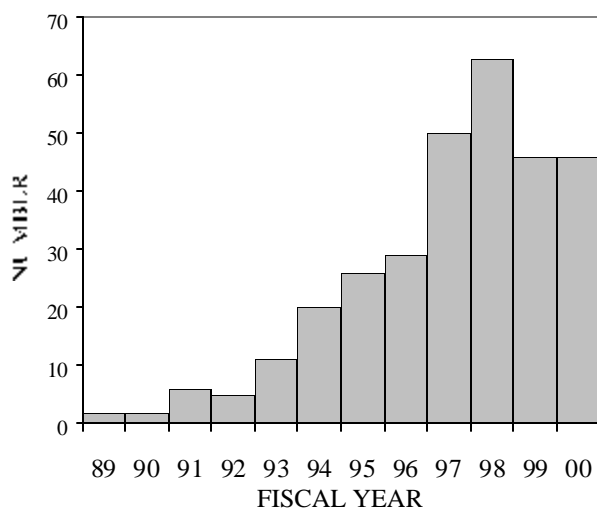


Figure 1 – Number of CRADAs and amendments signed in FY89–FY00.

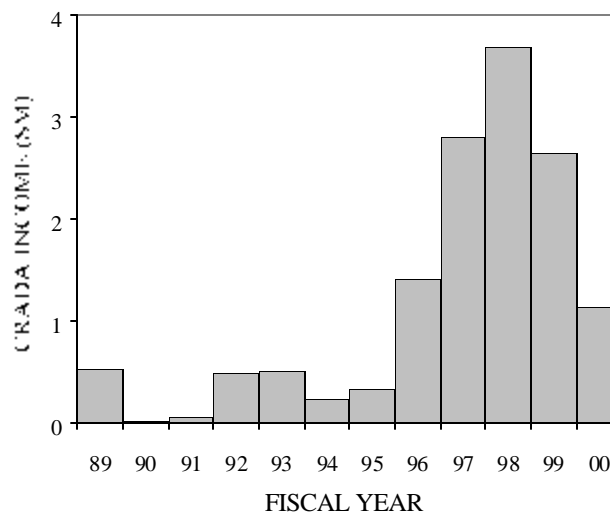


Figure 2 – Funding associated with CRADAs and amendments signed during FY89–FY00. Note: not all funds are scheduled to be received in the year that a CRADA or amendment is signed.

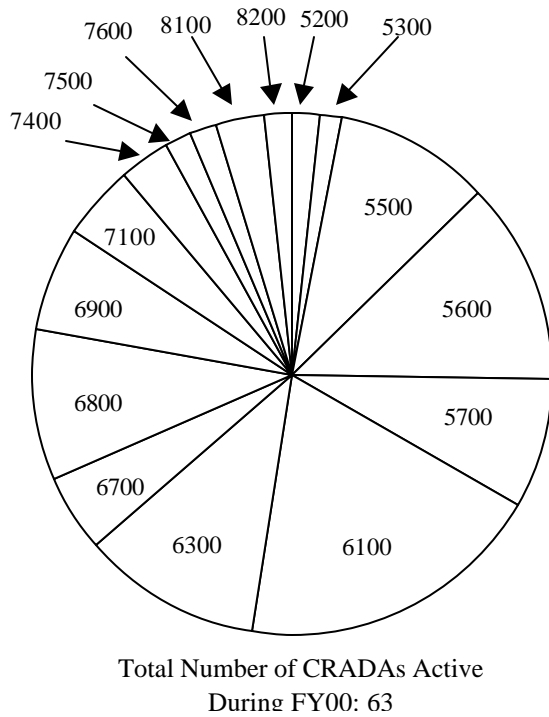


Figure 3 – Number of active CRADAs by NRL division number.

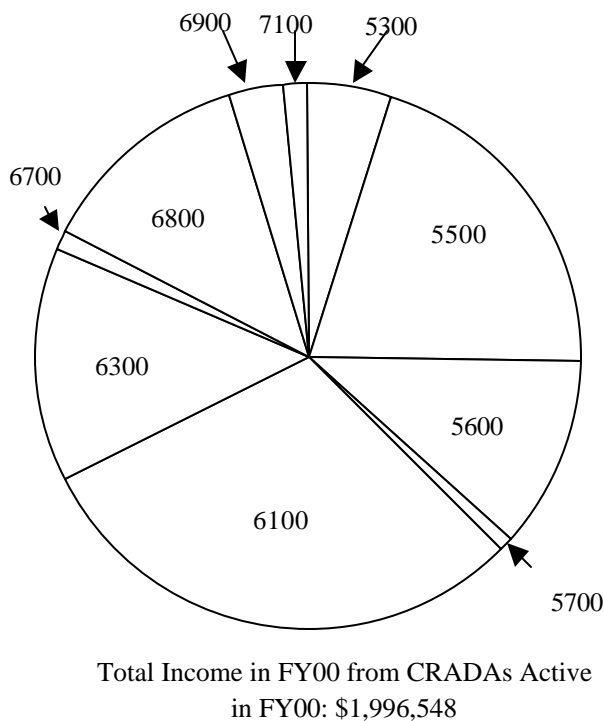


Figure 4 – Distribution of income received in FY00 from all CRADAs active during FY00 by NRL division number.

Stevenson-Wydler Technology Innovation Act of 1980, the Federal Technology Transfer Act of 1986, and the National Competitiveness Technology Act of 1989) is to encourage manufacturing in the United States. Figure 8 also shows the breakdown of NRL's active CRADAs according to whether the CRADA party is a foreign or domestic firm. Figure 9 shows the breakdown of NRL's active licenses according to size of licensee's business and whether the licensee is foreign-controlled. All of the foreign firms with whom NRL has signed licenses and CRADAs have agreed to manufacture the products derived from the agreements substantially in the United States.

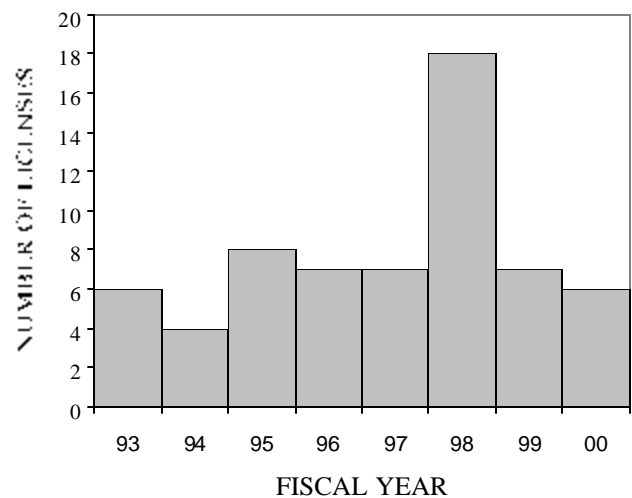


Figure 5 – Number of licenses signed from FY93–FY00.

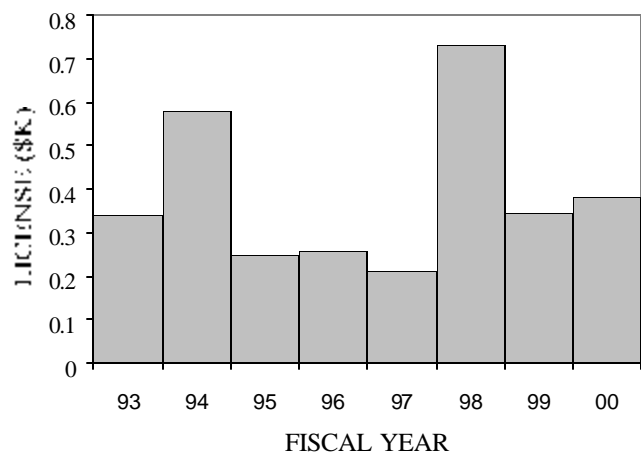
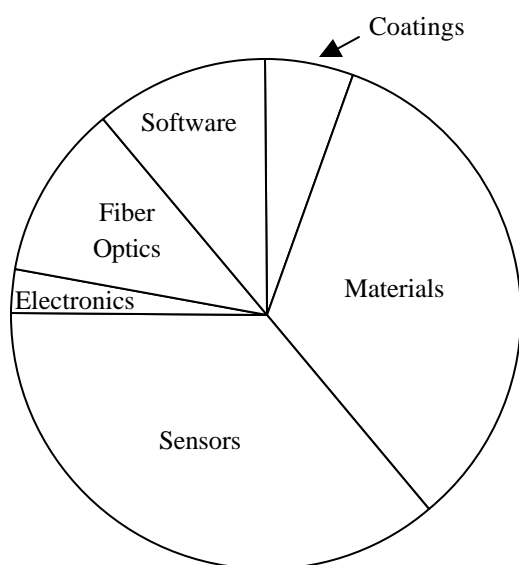


Figure 6 – Royalty income from FY93–FY00.



Total Number of Licenses Active in FY00: 36

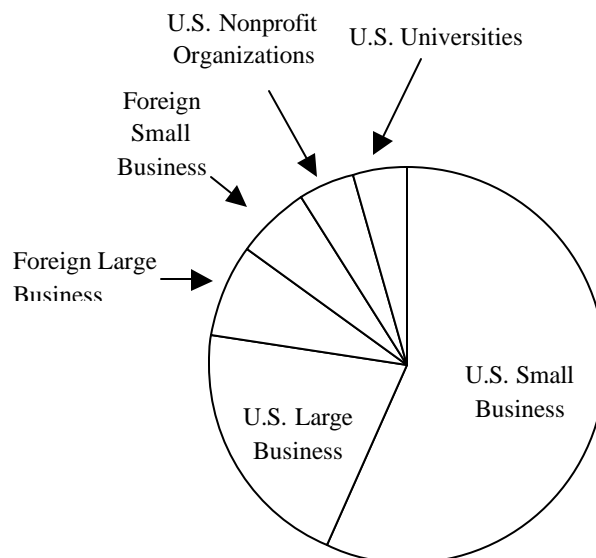
Figure 7 – Distribution of NRL's active licenses by subject area.

## Staffing

The Technology Transfer Office at NRL consists of three full-time professional staff members and two administrative staff members, one of whom works part-time. With respect to Technology Transfer mechanisms, the primary responsibilities of the Technology Transfer Office are the execution of CRADAs and PLAs, as well as recording those nondisclosure agreements (NDAs) that relate to Technology Transfer. The Technology Transfer Office works closely with the Office of Counsel at NRL. NRL's Office of Counsel is responsible for the following tasks related to the operation of the Technology Transfer Office: filing of patents, payment of filing and maintenance fees associated with NRL patents, and reviewing CRADAs, PLAs, and NDAs. The Office of Counsel also is responsible for coordinating with various NRL divisions to process agreements related to the sale of goods and services to non-Federal parties.

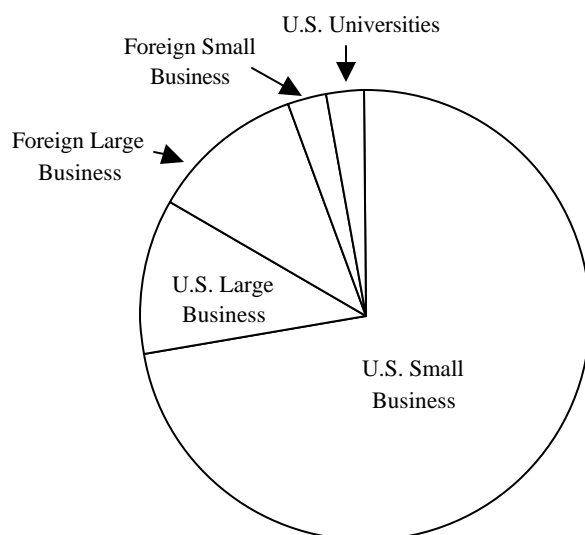
## Head of Technology Transfer

The head of NRL's Technology Transfer Office is Dr. Catherine M. Cotell. Dr. Cotell received her B.A. in chemistry and mathematics from Wellesley College and her S.M. and Ph.D. degrees from the



Total Number of Active CRADA Parties: 67

Figure 8 – Identification of parties with whom NRL had active CRADAs in FY00 according to size of business, nonprofit organization, or university, and whether foreign or domestic. Note that the number of CRADA parties exceeds the number of CRADAs in Figure 3 because several CRADAs were multiparty agreements.



Total Number of Licenses Active in FY00: 36

Figure 9 - Distribution of NRL's active licenses according to size of business, nonprofit organization, or university, and whether foreign or domestic.



Massachusetts Institute of Technology in metallurgy and materials science and engineering, respectively. After two years as a member of the technical staff at AT&T Bell Laboratories (now Lucent Technologies), Dr. Cotell joined the staff of the Condensed Matter and Radiation Sciences Division in the Materials Directorate at NRL. Her research was in surface modification and thin film coatings for electronic, optical, and biomedical applications. She joined the staff of the Technology Transfer Office in June of 1997 and assumed the position of head of the Office in April of 1999.

As head of Technology Transfer at NRL, Dr. Cotell is responsible for enhancing the transfer of NRL technology to users of the R&D products of the laboratory as well as the transfer of technology from outside sources to NRL in order to enhance the mission of the laboratory. The head of the Technology Transfer Office is directly responsible for initiating programs that will generate and stimulate the transfer of technology. These programs include the Office of Research and Technology Applications (ORTA) program, the stimulation, preparation, and guidance of CRADAs; the marketing of NRL's intellectual property portfolio; the negotiation and preparation of PLAs; the dissemination of technical information within and outside NRL; the facilitation of collaborations and interactions between NRL researchers and the commercial sector; and the stimulation of initiatives to develop the transfer of technology to other organizations. The head of Technology Transfer is responsible for the technical assessment of the programs within NRL relative to opportunities arising external to NRL in the Navy, Department of Defense, and sponsor communities. The head of Technology Transfer is called upon to conduct negotiations, draft agreements, and manage NRL's intellectual property portfolio, as well as coordinate legal work in connection with negotiating PLAs; negotiate and settle patent claims; and negotiate patent clauses in contracts. The head of Technology Transfer interacts with all levels from a diverse professional community effecting the coordination of people, programs, tasks, goals, visits, funding, and reports.

### ***Technology Transfer Specialist***

Dr. Celia Merzbacher holds the position of Technology Transfer Specialist. Dr. Merzbacher received her B.A. in geology from Brown University and her M.S. and Ph.D. degrees from the

Pennsylvania State University, both in Geochemistry and Mineralogy. Following a post-doctoral research appointment at Lawrence Livermore National Laboratory, Dr. Merzbacher joined the staff of the Optical Sciences Division at NRL. Her research has been in aerogels and glassy materials for optical and electronic applications. She joined the staff of the NRL Technology Transfer Office in January 1999.

As Technology Transfer Specialist, Dr. Merzbacher is responsible for preparing application assessments for selected research and development projects for the laboratory; providing and disseminating information on Federally owned or originated products, processes and services having potential application to state and local governments, academia, and private industry; assisting the National Technical Information Service, the Federal Laboratory Consortium for Technology Transfer, and other organizations linking the research and development resources of NRL to state and local governments, academia, and private industry; participating in regional, state and local programs to facilitate or stimulate the transfer of technology; providing insight for potential and existing CRADAs; assisting NRL program/technical managers to identify technologies suitable for transfer; coordinating domestic technology transfer efforts with small and disadvantaged businesses for the purpose of stimulating commercialization of appropriate technologies by small businesses; and preparing pamphlets and brochures to be distributed to interested parties.

### ***Program Analyst***

Dorothy F. Vincent is the Program Analyst in the NRL Technology Transfer Office. Ms. Vincent received her B.S. degree in Business and Management and her M.G.A. (Master of General Administration) with a specialization in Procurement and Contract Management from the University of Maryland. Ms. Vincent worked in private industry for 25 years in the areas of administration, accounting, and project management before joining the Federal government in 1992. She assumed her current position in the Technology Transfer Office in January 1994.

The responsibilities of the Program Analyst in the Technology Transfer Office include planning, developing, analyzing and implementing automated systems and databases necessary to transfer NRL technology to the private sector and to government agencies efficiently; preparing charts, graphs, and

statistical and narrative data for presentations, briefings, and exhibits; analyzing and preparing CRADAs and PLAs to ensure compliance with Technology Transfer legislation and Navy policy; providing online data searches; preparing year-end reports of CRADA and PLA activity; maintaining the records for NRL's Technology Transfer input to the Office of Naval Research Defense Technology Transfer Information Systems (DTTIS) database used to track CRADA and PLA activity; maintaining an in-house database to track PLA activity in various stages of progress; compiling relevant information (assignments, patents, filings, notices) pertinent to PLAs; and acting as liaison between the Technology Transfer Office and the NRL Public Affairs Division to coordinate and distribute inventor fact sheets.

## FY00 IN REVIEW

### Intellectual Property

The information in Table 1 was provided by the NRL Office of Counsel to summarize intellectual property actions at NRL during FY00. Because most technology transfers involve the protection and transfer of rights in intellectual property, a comprehensive review of technology transfer at NRL should include a reporting of intellectual property actions.

**Table 1 - Intellectual Property Actions Taken By NRL in FY00.**

Invention Disclosures Filed	112
U.S. Patent Applications Filed	69
Foreign Patent Applications Filed	28
U.S. Patents Issued	98
Foreign Patents Issued	Not available
Total Number of U.S. Patents to which NRL held title in FY00	550

### Cooperative Research and Development Agreements

A summary document describing the CRADA activity at NRL in FY00 is attached as Appendix B. NRL entered into 15 new CRADAs and signed 31 amendments to existing CRADAs. Four CRADAs were terminated by mutual agreement between NRL and the CRADA party. Three of these were

terminated at the initiation of the CRADA party because their business directions had changed such that the technology being pursued under the CRADA was no longer strategic. In the fourth case, the agreement was with a university and the university program manager moved to another institution. The total income to NRL associated with the CRADAs and CRADA amendments signed in FY00 is \$1,133,381. Note, this figure represents the total funding associated with agreements signed in FY00. Not all of the funding was scheduled to be received in the same fiscal year; many of the CRADAs were multiyear agreements with funding schedules that extend throughout the duration of the programs. Similarly, this amount does not include funds received in FY00 from CRADAs signed in previous years.

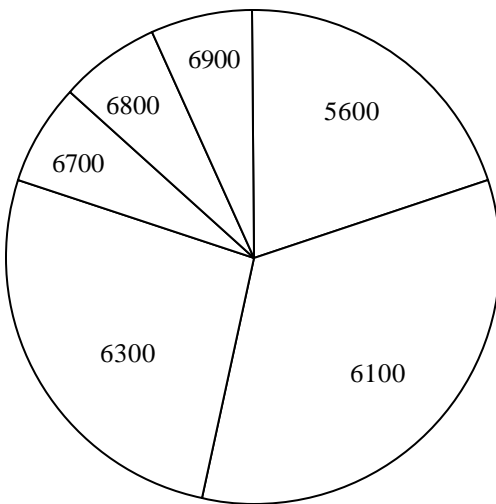
Table 2 and Figures 10 and 11 show the distribution of new FY00 CRADA activity and income over the different NRL divisions. Table 3 and Figures 12 and 13 show the distribution of FY00 CRADA amendments and associated income. Figure 14 shows the distribution of all FY00 income from CRADAs and CRADA amendments by NRL division number.

Eight of the 15 new CRADAs signed in FY00 do not include direct funding from the non-Navy party to NRL. In half of those CRADAs in which each party funds its own efforts, NRL's effort is supported with funding from a Government sponsor other than NRL, such as DARPA or NAVSEA. In the other cases, NRL's effort under the CRADA is supported by, and falls under the scope of, current in-house 6.1 and 6.2 programs. For collaborative research in which each party funds its own efforts, the CRADA vehicle is useful to define the responsibilities of the parties toward achieving the objective of the collaborative research and to identify procedures for the protection of intellectual property.

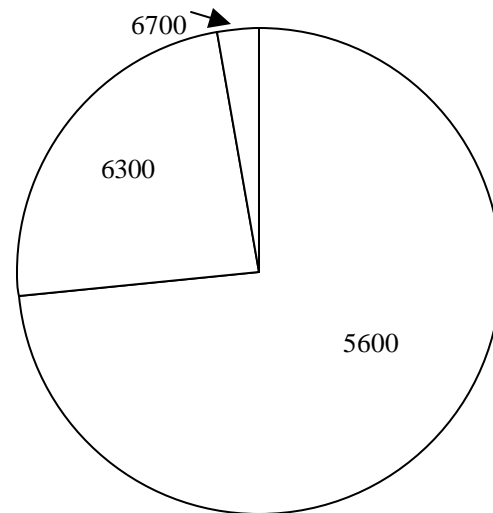
Some NRL technology transfers via CRADAs directly support Government priorities and programs. For example, a CRADA that has been underway with SeaSpace Corporation since August of 1998 supports the integration of NRL-Monterey's satellite meteorological application software modules into SeaSpace Corporation's TeraScan software package that is running on the Navy Satellite Display System-Enhanced at various locations around the world. Other examples include NRL's work under two different CRADAs, one with Blackhawk Geometrics and the other with Rocky Mountain Adaptive Software, to improve systems for detecting and mapping the location of buried unexploded ordnance.

**Table 2 - Number of CRADAs and Associated Income  
for New CRADAs Signed in FY00**

Division	Number of CRADAs	CRADA Income (\$)
5200	0	0
5300	0	0
5500	0	0
5600	3	258,000
5700	0	0
6100	5	0
6300	4	84,000
6400	0	0
6700	1	10,000
6800	1	0
6900	1	0
7100	0	0
7200	0	0
7300	0	0
7400	0	0
7500	0	0
7600	0	0
8100	0	0
8200	0	0
<b>Total</b>	<b>15</b>	<b>352,000</b>



Total Number of CRADAs: 15



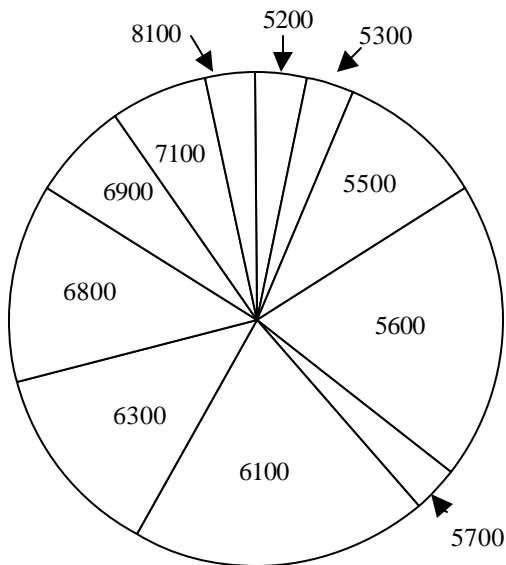
Total CRADA Funding: \$352,000

Figure 10 – Distribution of new FY00 CRADA activity by NRL division number.

Figure 11 – Distribution of new FY00 CRADA income by NRL division number.

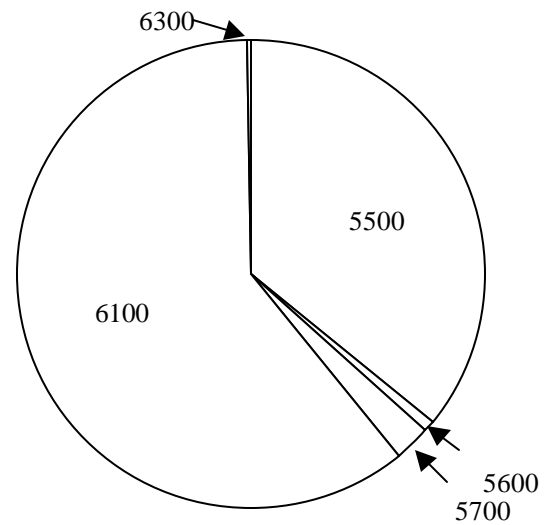
**Table 3 - Number of CRADA Amendments and Associated Income for New CRADA Amendments Signed in FY00**

Division	Number of Amendments	CRADA Amendment Income (\$)
5200	1	0
5300	1	0
5500	3	279,881
5600	6	6,500
5700	1	20,000
6100	6	472,000
6300	4	3,000
6400	0	0
6700	0	0
6800	4	0
6900	2	0
7100	2	0
7200	0	0
7300	0	0
7400	0	0
7500	0	0
7600	0	0
8100	1	0
8200	0	0
<b>Total</b>	<b>31</b>	<b>781,381</b>



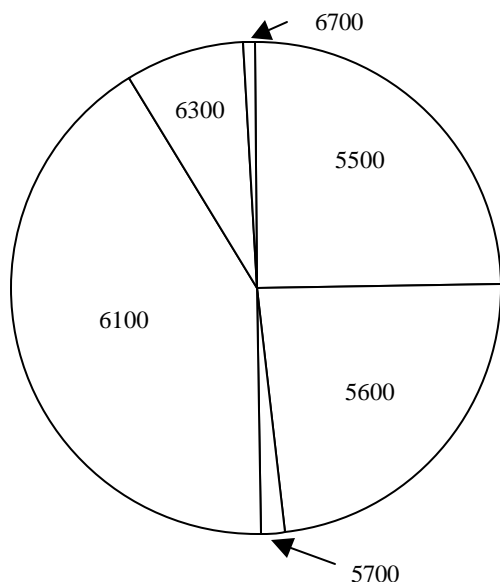
Total Number of Amendments: 31

Figure 12 – Distribution of amendments to CRADAs in FY00 by NRL division number.



Total FY00 CRADA Amendment Funding: \$781,381

Figure 13 – Distribution of FY00 CRADA amendment income by NRL division.



Total Funding from FY00 CRADAs and Amendments:  
\$1,133,381

Figure 14 – Distribution of income from all FY00 CRADAs and CRADA amendments by NRL division.

Two of the CRADAs under which NRL did collaborative research in FY00 supported the transfer of technology that NRL had previously licensed to the CRADA party. In a CRADA that has been underway since 1996, NRL works with its licensee, Lake Shore Cryotronics, to enhance the capabilities of NRL's Quantitative Mobility Spectrum Analysis (QMSA) method for characterizing the electrical properties of multi-layered semiconductor structures. Lake Shore has licensed this technology and incorporates the software written by NRL and collaborators at the University of Western Australia into a system that is sold to industrial and academic research institutions worldwide. This CRADA spawned a joint subject invention and the collaborators continue to make improvements.

Another example of a CRADA that supports a license is the CRADA with Schlumberger Technology Corporation signed in July of 2000. Schlumberger has a license for NRL's Fiber Bragg Grating Sensors. Under the scope of the CRADA, NRL and Schlumberger researchers are investigating the utility of these sensors in the field of oil and gas exploration.

## Patent License Agreements

A summary document describing the PLA activity at NRL in FY00 is attached as Appendix C. NRL entered into 4 new PLAs and amended 2 existing PLAs in FY00. One PLA was terminated by NRL when the licensee failed to make its minimum annual royalty payments. The total licensing fee and royalty income to NRL in FY00 from all active PLAs was \$381,388.

Figure 15 shows the breakdown of FY00 royalty income according to type of payment: upfront licensing fee, minimum annual royalty payment, or royalty on sales of royalty-bearing product in excess of the minimums. The small dollar value for royalties due over and above the minimum annual royalties is rather disappointing. NRL selects the dollar value for minimum annual royalties based on the licensee's business plan. Minimum annual royalty payments are not designed to be onerous and it is anticipated that royalties on actual sales will exceed these minima. The low value of royalty income over and above the minima suggests that NRL's licensees are either slower to introduce product to the market than their business plans projected, or that their sales volumes have been less than projected. In one case, a licensee has faced regulatory issues related to safety approval of product that slowed product introduction. In the case of some of NRL's licenses, due to the fact that the patents were near expiration, the licenses were structured such that payment was entirely in the

Royalties on Sales in Excess of Minimum  
Annual Royalties: \$605 ▼

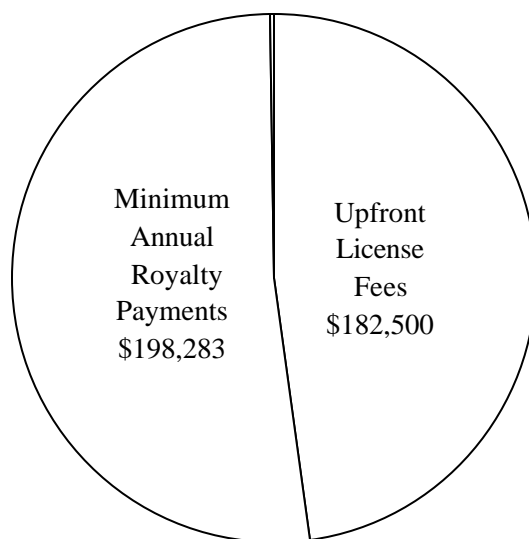


Figure 15 – Type of royalty income received in FY00.

form of an upfront fee; that is, to simplify accounting for the short duration of these licenses, no royalties on sales were due. As NRL's licensing program matures, a higher percentage of licensing income is expected to come from royalties on sales and it is expected that companies will owe royalties on sales over the minimum royalties.

Two of the licenses signed in FY00 were for NRL's portfolio of patents covering phthalonitrile resins for lightweight, flame-resistant composites. These resins were developed in NRL's Chemistry Division under the direction of Dr. Teddy Keller. GKN Westland Aerospace will be using these composites in components for aerospace, marine and transportation applications. Eikos, Inc., a small business, will be selling test and evaluation quantities of these resins to hardware manufacturers who are contemplating the use of phthalonitrile composites in their product lines. Positive test results derived from use of materials supplied by Eikos may lead to other licenses for hardware manufacture by Eikos' customers.

Optocom Innovation signed a license to manufacture side-pumped fiber amplifiers, as well as lasers and test and measurement equipment utilizing these amplifiers, which were invented by Dr. Lew Goldberg of NRL's Optical Sciences Division. Optocom Innovation's amplifier is shown in Figure 16. This patent has generated widespread interest in the laser manufacturing community. NRL has received license applications from several other manufacturers who are also interested in licensing this technology.

Nova Engineering signed a license for NRL's Temporally Ordered Routing Algorithm (TORA). TORA is a novel approach to routing that is tailored

for use in dynamic wireless networks. Traditional routing algorithms used today to find paths for forwarding information in computer and communications networks are designed for operation in relatively static hardwired networks and are not well suited for use in emerging mobile wireless networks. The TORA algorithm invented by Mr. Vincent Park of NRL's Information Technology Division and Dr. Scott Corson of the University of Maryland solves that problem. Under license from NRL and the University of Maryland, NOVA Engineering is selling a wireless router product, the NovaRoam 900 shown in Figure 17, based on the TORA technology.

### Sales of Goods and Services to Non-Federal Parties

Sales of goods and services to non-Federal parties fall under four categories: testing authorized under 10 U.S.C. §2539b; any other services or supplies under 10 U.S.C. §2553; testing or other quality assurance demonstration for offerors under 10 U.S.C. §2319; and performance of research and development functions under the pilot program in Section 246 of the FY99 National Defense Authorization Act (P.L. 105-261). These sales are processed through the Office of Counsel and the Financial Management Division at NRL, not the Technology Transfer Office. However, they are included in this report because even though these sales do not constitute cooperative research or confer intellectual property rights, they may, in fact, transfer NRL's technology or catalyze future technology transfer. The Technology Transfer Office and the Office of Counsel work closely together and on a

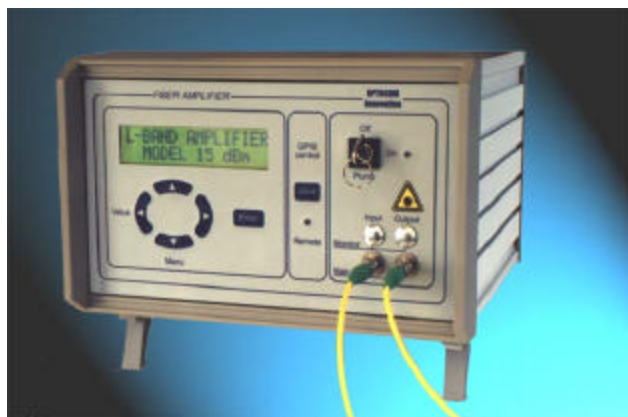


Figure 16: Optocom Innovation's Fiber Amplifier Model 15, sold under license from NRL.

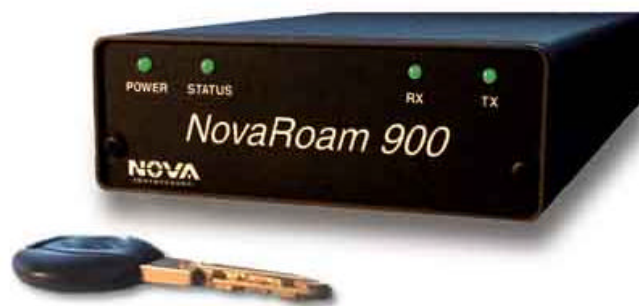


Figure 17: Nova Engineering's NovaRoam 900 wireless router sold under license from NRL.

case-by-case basis determine whether the work proposed to be done under these statutory authorities would more appropriately be done under the scope of a CRADA and reciprocally whether certain proposed CRADAs would more appropriately be handled under these other statutory authorities. In part because of expanded statutory authority to do such sales and in part because of increased interaction between the Office of Counsel and the Technology Transfer Office regarding the use of sales or CRADA mechanisms, the numbers of sales under these authorities increased in FY00.

In FY00, NRL sold goods or services under 10 U.S.C. §2539b, 10 U.S.C. §2319, and the pilot program in Section 246 of the FY99 National Defense Authorization Act (P.L. 105-261). In FY00, NRL initiated no sales under 10 U.S.C. §2553. Appendix D describes the goods and services. Financial data reported in Appendix D are projections over the life of each project initiated in FY00, not actual receipts for FY00.

### **Vice Admiral Harold G. Bowen Award**

At a ceremony at ONR on 14 March 2000, NRL inventors Dr. Robert Brady of the Chemistry Division and Mr. Larry Kraft formerly of the Chemistry Division, were presented with the Vice Admiral Harold G. Bowen Award in recognition of their invention of nonskid coating formulations that are used on Navy vessels. The Bowen Award is named in honor of the first Chief of Naval Research. The award recognizes patented inventions of present or past Navy employees that have had a significant impact on the operation of the Navy. A single Bowen Award is given each year. The nonskid coatings recognized by the Bowen Award this year provide traction and directional control to men and machinery operating on decks of aircraft carriers, amphibious assault ships ("helicopter carriers") and air-capable ships. The patented coating has a service life of 24-30 months, compared to 8-9 months for the coating it replaced. The Bowen Award in recognition of this significant technology transfer to the Fleet was presented by RADM Paul Gaffney, Chief of Naval Research.

### **FY00 Trends**

The FY99 Technology Transfer Annual Report predicted that the number of new CRADAs and CRADA amendments signed annually may plateau at between 40 and 50 per year. Data from FY00 seem

to support this prediction. The number of new CRADAs is down, while more CRADAs are being amended to lengthen the duration of the collaborations or add new work to the programs.

The number of NRL divisions participating in the CRADAs is down. In FY99, 11 NRL divisions entered into new CRADAs with 5 divisions signing funded CRADAs. In FY00, only 6 divisions entered into new CRADAs, with 3 divisions signing funded CRADAs. Of the 6 divisions signing new CRADAs in FY00, all but one (Code 5600) were in the Materials Directorate (Code 6000). Amendments to CRADAs were more evenly distributed across the laboratory.

NRL's licensing program is also dominated by materials and materials-related technology originating in Codes 5000 and 6000. The number of licensees requesting technical assistance from NRL to facilitate the transitioning of NRL technology under license is growing. The ability of the technical divisions to accommodate such requests for CRADAs or other means of providing technical support to a licensee during the early stages of commercialization is an important element to the success of NRL's licensing program.

NRL's royalty income stream is still in an unpredictable phase; that is, some years show substantially higher royalty income than others. This is due to the fact that a large fraction (~48% in FY00) of NRL's royalty income is derived from upfront licensing fees. Once more of the companies to whom NRL has licensed technology begin selling product and paying royalties on sales, it is anticipated that royalty income plotted against fiscal year will show a monotonic increase.

### **NEW INITIATIVES**

The primary objective of NRL's Technology Transfer Office is to assist with the transitioning of NRL developed technology into products and services available to the public. Among the specific goals toward achieving that objective is to increase the number of NRL patents licensed.

In FY00, the Technology Transfer Office upgraded its website to feature technologies that are available and ready for commercialization. The website now contains a search engine that allows the user to search on keywords to identify NRL patents in the field of the keyword. Another web-based initiative of the Technology Transfer Office in FY00 is the development of a system for filing invention

disclosures online. NRL's Information Technology Division provided a talented programmer, Tyrone Broadway, who in consultation with the Technology Transfer Office and the Office of Counsel for Intellectual Property has designed a secure, interactive web page with help menus and frequently asked questions that will guide the NRL inventor through the steps to file an invention disclosure. Data entered by the inventor will be stored in a database that will aid in record-keeping by the Office of Counsel for Intellectual Property. The database will automatically upload required data to ONR's Intellectual Property Management Information System (IPMIS) and will provide information to NRL's Invention Evaluation Board (IEB) electronically, thus reducing the workload on Code 1008.2 clerical staff. In addition, parts of this database that contain publicly releasable information will be searchable on the Technology Transfer website. By entering keywords, users will be directed to licensable NRL technologies in those fields. Finally, data from the database will be accessible in the form of a status report that the inventors can query to keep track of filing deadlines, U.S. Patent and Trademark Office actions, and licensing activity related to each of their disclosures. The web page was designed to be an easily accessible resource for forms and instructions on filing invention disclosures and patent applications, to enhance communication between the inventor and the

patent attorney processing each case, as well as to allow authorized NRL staff to monitor the various stages in the filing of a patent application. The system is scheduled for beta testing in the first quarter of FY01.

Another public awareness initiative taken by the Office of Technology Transfer in FY00 was to work with the Public Affairs Office Exhibits program to increase the effectiveness of NRL's exhibits at trade shows and technical meetings. The Technology Transfer Office assisted with the identification of technical personnel and demonstrations that could be present at the NRL exhibit booth at several meetings in FY00. A Technology Transfer staff member attended two such meetings. Experience has shown that the presence of technical personnel significantly increases the likelihood that a valuable contact resulting in future interaction will be made at such exhibits.

The Technology Transfer Office has also worked to increase the sensitivity and awareness of the NRL scientific community to intellectual property development and protection. In FY00, a regular feature was introduced to Lababstracts to highlight particular intellectual property topics and to provide contact information for resources for more information and guidance. Topics covered in articles in FY00 included nondisclosure agreements and CRADAs.



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## Appendix A

### NRL RESEARCH DIVISIONS

<u>Code</u>	<u>Name</u>
5200	Technical Information
5300	Radar
5500	Information Technology
5600	Optical Sciences
5700	Tactical Electronic Warfare
6100	Chemistry
6300	Materials Science and Technology
6400	Laboratory for Computational Physics and Fluid Dynamics
6700	Plasma Physics
6800	Electronics Science and Technology
6900	Center for Biomolecular Science and Engineering
7100	Acoustics
7200	Remote Sensing
7300	Oceanography
7400	Marine Geosciences
7500	Marine Meteorology
7600	Space Science
8100	Space Systems Development
8200	Spacecraft Engineering

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## Appendix B

### FY00 CRADA REVIEW 1 October 1999 to 30 September 2000

#### **NEW CRADAs**

##### **99-256**

##### **Tool for Computer-Controlled Automation of the MAPLE Direct-Write Method CRADA Between NRL and Potomac Photonics, Inc. (PPI)**

NRL Principal Investigator: Douglas B. Chrisey, Code 6372

PPI Principal Investigator: Michael Duignan

Funding: Each party will fund its own efforts

Duration: 36 months

Signed: 9 December 1999

One objective of this CRADA is to develop material, processes, hardware and software to allow fully-automated, rapid deposition using the laser transfer process called Matrix-Assisted Pulsed Laser Evaporation Direct Write (MAPLE DW). A further objective is to demonstrate use of this tool for fabrication of electronic structures and devices, including, but not limited to, metal interconnects, resistors, multi-layer capacitors, inductors, antennae and batteries.

##### **00-258**

##### **Ultrasonic Non-Destructive Evaluation of Above-Ground Storage Tanks CRADA Between NRL and Solex Robotics Systems (SRS)**

NRL Principal Investigator: Richard Mignogna, Code 6350

SRS Principal Investigator: Don Hartsell

Funding: \$14,000

Duration: 8 months

Signed: 7 November 1999

Under this CRADA, the ability of NRL's non-destructive evaluation system called Spectral Tracking to measure the thickness of above-ground storage tank bottoms and will be compared with that of SRS' ultrasonic time-of-flight system.

##### **00-259**

##### **Development of Coatings for Corrosion Control CRADA Between NRL and Niles Chemical Paint, Inc. (NCP)**

NRL Principal Investigator: Arthur A. Webb, Code 6138

NCP Principal Investigator: Donald B. Dahm

Funding: Each party will fund its own efforts

Duration: 24 months

Signed: 28 February 2000

The objectives of this CRADA are to evaluate (1) a solvent-free, surface tolerant coating for ship tanks and wet spaces and underwater hulls and (2) an inorganic aluminum coating, or primer, for corrosion control of stainless steel.

**00-262****Effects of Electrode Conditioning on High Power Discharges in Flash X-Ray Diodes  
CRADA Between NRL and Ecopulse, Inc. (EPI)**

NRL Principal Investigator: Steven H. Gold, Code 6793

EPI Principal Investigator: Nino Pereira

Funding: \$10,000

Duration: 6 months

Signed: 23 December 1999

The objective of this CRADA is to investigate various methods to suppress diode collapse in flash X-ray diodes by controlling the electrode surface conditions.

**00-264****Microbial Production of Heavy Metal Biosorbents  
CRADA Between NRL and MBI International (MBI)**

NRL Principal Investigator: Mihran Pazirandeh, Code 6930

MBI Principal Investigator: Thomas L. Deits

Funding: Each party will fund its own efforts

Duration: 8 months

Signed: 12 April 2000

The objective of this CRADA is to combine the capabilities of NRL's metal binding peptides with MBI's expression system to produce a new microbial-based, heavy metal biosorbent.

**00-265****Signal Processing for Fiber Optic Medical Sensors  
CRADA Between NRL and Advanced Sensor Technology (AST)**

NRL Principal Investigator: Sandeep T. Vohra, Code 5673

AST Principal Investigator: Frank Bucholtz

Funding: \$60,000 for tasks 1-4 or \$53,000 for tasks 1,2, and 4

Duration: 6 months

Signed: 9 March 2000

The objective of this CRADA is to develop and test an electro-optical signal processor for use with a fiber optic sensor for medical applications. It is also an objective of this Agreement to transfer knowledge of the design and fabrication of electro-optical signal processors from NRL to AST.

**00-268****Investigation of Increased Spontaneous Fission Rate of 235-U Under Acoustic Compression  
CRADA Between NRL and JWK International (JWK)**

NRL Principal Investigator: Robert August, Code 6173

JWK Principal Investigator: Lawrence P.G. Forsley

Funding: Each party will fund its own efforts

Duration: 4 months

Signed: 27 April 2000

The objective of this CRADA is to verify the conditions of supercritical fission by monitoring the spontaneous fission rate of nearly pure 235-U in aqueous solution during cavitation. If an increase in the fission rate is observed, NRL and JWK will plan follow-on research and seek additional funding.

**00-269****Pulsed Laser Deposition of Ferroelectric Thin Films for Tunable Microwave Devices  
CRADA Between NRL and Paratek Microwave, Inc. (PMI)**

NRL Principal Investigator: James Horwitz, Code 6372

PMI Principal Investigator: Xubia Zhang

Funding: \$40,000

Duration: 9 months

Signed: 18 May 2000

The objective of this CRADA is to obtain a thin film material that exhibits a loss tangent of 0.004 at 10 GHz and a tunability of 30 percent for a 10-volt bias.

**00-270****SiGe Interband Tunneling Diodes  
CRADA Between NRL and the University of Delaware (UD)**

NRL Principal Investigator: Phillip E. Thompson, Code 6812

UD Principal Investigator: Paul R. Berger

Funding: Each party will fund its own efforts

Duration: 14 months

Signed: 20 April 2000

The objective of this CRADA is to develop a SiGe resonant interband tunneling diode that has a peak-to-valley current ration (PVCR) greater than 4.

**00-271****Development of Metal-free Anti-fouling Coatings Using a Non-persistent Biocide  
CRADA Between NRL and Sigma Coatings BV (SCBV)**

NRL Principal Investigator: Arthur Webb, Code 6138

SCBV Principal Investigator: Michael Winter

Funding: Each party will fund its own efforts

Duration: 36 months

Signed: 22 June 2000

The objective of this CRADA is to develop a biocide-based, anti-fouling coating for ships that is metal-free and has acceptable performance characteristics.

**00-272****Apparatus and Procedure for Testing Fiber Optic Accelerometers  
CRADA Between NRL and Litton Systems, Inc., Guidance & Control Systems Division (LGCS)**

NRL Principal Investigator: Gregory Nau, Code 5674

LGCS Principal Investigator: Linda Armijo

Funding: \$30,000

Duration: 2 months

Signed: 27 April 2000

The objective of this CRADA is to establish a low-cost system for testing fiber optic accelerometers at LGCS that ultimately will allow final calibration and qualification during the sensor manufacture process.

**00-273****Fiber Optic Sensors for Oil Exploration****CRADA Between NRL and Schlumberger Technology Corporation (STC)**

NRL Principal Investigator: Gary Cogdell, Code 5603

STC Principal Investigator: Robert Schroeder

Funding: \$175,000

Duration: 24 months

Signed: 26 July 2000

The objective of this CRADA is to develop fiber optic geophones and accelerometers, based on existing NRL technology, that meet STC requirements for oil exploration. It is also an objective of this Agreement to enable STC to fabricate and test fiber optic accelerometer systems by the transfer of NRL's knowledge about such sensor systems.

**00-274****Data Collection and Transmission for Tank and Void Corrosion Monitoring System****CRADA Between NRL and Veriteq, Inc. (VI)**

NRL Principal Investigator: Paul Slebodnick, Code 6136

VI Principal Investigator: Kevin Bull

Funding: Each party will fund its own efforts

Duration: 36 months

Signed: 21 July 2000

The objective of this CRADA is to develop low-cost data collection and data transmission instrumentation and to interface these components with each other and with NRL's corrosion sensor and analysis systems. It is also an objective of this Agreement to develop a high-pressure data collection system for measurement of corrosion in deep water.

**00-276****Development of Drug Compliance Chemical Detector****CRADA Between NRL and Nanosphere, Inc. (NI)**

NRL Principal Investigator: R. Andrew McGill, Code 6370

NI Principal Investigator: James D. Talton

Funding: \$30,000

Duration: 3 months

Signed: 22 June 2000

The objective of this CRADA is to develop and demonstrate a SAW sensor array detector that is capable of detecting by breath analysis specific pharmaceuticals or odorant taggants. If successful, a follow-on program will be developed.

**00-282**

**A Neural Network Ensemble Approach for Unexploded Ordnance (UXO) Classification in Magnetometry Surveys**

**CRADA Between NRL and Rocky Mountain Adaptive Software, LLC (RMAS)**

NRL Principal Investigator: Sean Hart, Code 6116

RMAS Principal Investigator: David Opitz

Funding: Each party will fund its own efforts

Duration: 12 months

Signed: 31 August 2000

The objective of this CRADA is to evaluate whether RMAS' Genetic Feature Selection (GEFS) algorithm can identify unexploded ordnance using existing data from the Multi-sensor Towed Array Detection System (MTADS) Data Analysis System (DAS).



## **CRADA AMENDMENTS**

### **95-079 (Amendment #4 & #5)**

#### **Quantitative Mobility Spectrum Analysis for Hall Evaluation Software Package CRADA Between NRL and Lake Shore Cryotronics, Inc. (LSCI)**

Original NRL Principal Investigator: Jerry R. Meyer, Code 5613

Original LSCI Principal Investigator: John K. Krause

Original Funding: \$50,000

Original Duration: 24 months

Original Signed: 23 July 1996

The objective of this CRADA is to develop and make available to the semiconductor community a software package based on the Quantitative Mobility Spectrum Analysis (QMSA) algorithm for evaluating magnetic-field-dependent Hall and resistivity measurements. The package may be used either as a built-in component of Lake Shore Hall instrumentation or in conjunction with data acquired by any other Hall system. By providing a more accurate and computer-automated analysis algorithm than has been available previously, this CRADA will lead to significantly enhanced capabilities for routinely characterizing multiple electron and hole densities and mobilities in semiconductor samples, including bulk, thin film, and quantum well materials and devices. Suitable for use by both experts and non-experts, the product will benefit Navy, other Department of Defense, industrial, and university laboratories and production facilities involved in the development and characterization of semiconductor materials and devices.

#### **Fourth Amendment:**

Signed: 3 February 2000

Duration: Extended 6 months. Expires 23 July 2000

Funding: Payment schedule modified

The CRADA is amended by modifying the payment schedule in Article 8.1 and the duration in Article 14.2.

#### **Fifth Amendment:**

Signed: 21 July 2000

Duration: Extended 3 months. Expires 23 October 2000

The CRADA is amended by modifying the duration in Article 14.2.

### **96-119 (Amendment #3 & #4)**

#### **Radiation Hardness In Thin Simox**

#### **CRADA Between NRL and Ibis Technology Corporation (ITC)**

Original NRL Principal Investigator: Harold Hughes, Code 6816

Original ITC Principal Investigator: Lisa Allen

Original Funding: \$120,000

Original Duration: 12 months

Original Signed: 20 February 1997

The objective of this CRADA is to determine optimal processes parameters to maximize radiation hardness of thin box SIMOX.

**Third Amendment:**

Signed: 30 March 2000

Duration: Extended 3 months. Expires 1 July 2000

ITC Principal Investigator: Michael L. Alles

The CRADA is amended by modifying the Ibis Personnel in Article 6.2.2 and the duration in Article 14.2.

**Fourth Amendment**

Signed: 30 June 2000

Duration: Extended 3 months. Expires 1 October 2000

The CRADA is amended by modifying the duration in Article 14.2.

**97-132 (Amendment #1)****Ion Implantation Technology for GaN and Related Alloys****CRADA Between NRL and Implant Sciences Corporation (ISC)**

Original NRL Principal Investigator: Harry Dietrich, Code 6856

Original ISC Principal Investigator: Anthony Armini

Original Funding: Each party will fund its own efforts

Original Duration: 3 years

Original Signed: 28 January 1997

The objective of this CRADA is to develop and implement for device and IC fabrication, an implantation technology for GaN and its related alloys.

**First Amendment**

Signed: 29 December 1999

Duration: Extended 36 months. Expires 28 January 2003

The CRADA is amended by modifying the duration in Article 14.2.

**97-135 (Amendment #1)****Digital Library Research****CRADA Between NRL and Visual History Foundation (VHF)**

Original NRL Program Manager: Henry Dardy, Code 5590

Original VHF Program Manager: Sam Gustman

Original Funding: Each party will fund its own efforts

Original Duration: 36 months

Original Signed: 3 July 1997

The objective of this CRADA is to conduct basic Digital Library Research and evaluate innovative concepts.

**First Amendment:**

Signed: 28 June 2000

Duration: Extended 36 months. Expires 3 July 2003

The CRADA is amended by modifying the duration in Article 14.2.

**97-142 (Amendments #3 & #4)****Diamond Based Materials Research****CRADA Between NRL and Diamond Microelectronics Corporation (DMC)**

Original NRL Principal Investigator: Pehr Pehrsson and James Butler, Code 6174

Original DMC Principal Investigator: Ross James

Original Funding: \$500,000

Original Duration: 24 months

Original Signed: 13 March 1997

The objective of this CRADA is to develop cost-effective diamond-based, high power/high frequency switches and assorted vacuum electronics.

**Third Amendment**

Signed: 27 October 1999

NRL Principal Investigators: Pehr Pehrsson, James Butler, Code 6174 and John Shaw, Code 6840

Funding: \$472,000

Duration: Extended 6 months. Expires 13 October 2000

The CRADA is amended by modifying the NRL Personnel in Article 6.2.1, the payment schedule in Article 8.1, the duration in Article 14.2, and the Statement of Work in Appendix A.

**Fourth Amendment**

Signed: 31 August 2000

DMC Principal Investigator: Bryant Cushing

Funding: Modified payment schedule

Duration: Extended 3 months. Expires on 31 January 2001

The CRADA is amended by modifying the DMC Personnel in Article 6.2.2 and Article 13.2.6, the payment schedule in Article 8.1 and the duration in Article 14.2.

**97-155 (Amendment #3 and #4)****Development of Bi-Stable, High Resolution Reflective Display as a Memory Device****CRADA Between NRL and Opticom-ASA (O-ASA)**

Original NRL Principal Investigator: Ranganathan Shashidhar, Code 6950

Original O-ASA Principal Investigator: Per-Erik Nordal

Original Funding: \$250,000

Original Duration: 18 months

Original Signed: 18 September 1997

The objective of this CRADA is to develop and build a bi-stable, high resolution reflective display using conducting polymer based plastic substrates and further, to explore technical issues involved with a high definition electrical read and write memory device using a bi-stable cholesteric display and conducting polymer substrates.

**Third Amendment**

Signed: 3 December 1999

Funding: N/A - Payment schedule modified

Duration: Additional 7 months. Expires 18 June 2000

The CRADA is amended by modifying the payment schedule in Article 8.1, the duration in Article 14.2 and the Statement of Work.

**Fourth Amendment**

Signed: 7 February 2000

Company Name: Changed to Thin Film Electronics ASA (TFE)

TFE Principal Investigator: Changed to Johan Carlsson

The CRADA is amended by modifying Article I to change the name of the non-Navy party company name throughout the Agreement, the address to Thin Film Electronics ASA, Stoperigata 2, 0124 Oslo, Norway, and Article 6.2.2 to change the TFE Personnel to Johan Carlsson. Appendix C, containing the assignment of the CRADA by Opticom to TFE, is added.

**97-159 (Amendment #2)****Fiber Optic Seismic Systems****CRADA Between NRL and Optical Products, Inc. (OPI)**

Original NRL Principal Investigator: Anthony Dandridge, Code 5670.1

Original OPI Principal Investigator: Steven J. Maas

Original Funding: \$120,000

Original Duration: 12 months

Original Signed: 19 November 1997

The objective of this CRADA is to conduct basic studies and evaluate innovative concepts for fiber optic sensor systems for the marine exploration of oil and gas reserves. In particular, NRL has developed optical fiber technology for Navy towed array applications. The objective of this cooperative research is to develop and refine these fiber optic technologies for seismic applications.

**Second Amendment:**

Signed: 16 November 1999

Duration: Extended 3 months. Expires 19 February 2000

The CRADA is amended by modifying the duration in Article 14.2.

**97-166 (Amendment #2)****Anti-Ship Cruise Missile (ASCM) Tactical Analysis Workstation Development****CRADA Between NRL and Sippican, Inc., Hycor Group (HYCOR)**

Original NRL Principal Investigator: Allen Duckworth, Code 5707

Original HYCOR Principal Investigator: Richard Porter

Original Funding: \$10,000

Original Duration: 6 months

Original Signed: 21 April 1998

The objectives of the cooperative research are:

- (1) To expand on HYCOR's tactical analysis workstation model to enable modeling of both RF and IR missile engagements;
- (2) To develop a graphical user interface that can be shared by both the RF and IR missiles; and
- (3) To perform initial verification and validation efforts on the PC-based workstation model.

**Second Amendment**

Signed: 28 October 1999

Funding: \$20,000

Duration: Extended 12 months. Expires 21 October 2000

The CRADA is amended by modifying the payment schedule in Article 8.1, the duration in Article 14.2, and the Statement of Work in Appendix A.

**98-190 (Amendment #1)****Improved Electronic Access to Journals Published by the American Institute of Physics  
CRADA Between NRL and American Institute of Physics (AIP)**

Original NRL Principal Investigator: Rod Atkinson, Code 5220

Original AIP Principal Investigator: Tim Ingoldsby

Original Funding: \$58,147

Original Duration: 15 months

Original Signed: 14 October 1998

The objective of this CRADA is for NRL and AIP to work together to improve electronic access to AIP-published journals. AIP will provide to NRL a group of older AIP core archival and translation journals. NRL will digitize these journals by scanning their contents into high quality PDF files. The digitized versions of these older archival journals can be made available, for example on the Web, in an electronic format consistent with that of more recently published journals.

**First Amendment**

Signed: 22 October 1999

NRL Principal Investigator: James King

Duration: Extended 11 weeks. Expires 31 December 1999

The CRADA is amended by modifying the NRL Personnel in Article 6.2.1 and the duration in Article 14.2.

**98-197 (Amendment #1)****Development of Commercial Towed-Array System Including a Man Portable Multisensor Towed Array System (MTADS) Adjunct for Survey of Hazardous Metallic Material  
CRADA Between NRL and Geometrics, Inc. (GEO)**

Original NRL Principal Investigator: Jim R. McDonald, Code 6110

Original GEO Principal Investigator: Duane C. McCallister

Original Funding: \$175,000

Original Duration: 36 months

Original Signed: 30 September 1998

The objectives of the cooperative research program are: (1) The transfer of NRL's MTADS technology to GEO to allow manufacture and full implementation of one unit of a commercial towed array system for location and identification of buried metallic hazardous material such as unexploded ordnance. Such a system is in high demand by the Department of Defense for survey and characterization of current and former military ranges; and (2) The joint development and building by NRL and GEO of one unit of a man-portable adjunct to MTADS. This system will allow GEO to provide commercial services in areas where the vehicular MTADS cannot perform normally.

**First Amendment**

Signed: 14 October 1999

Company Name: Blackhawk-Geometrics, Inc. (BGI)

BGI Principal Investigator: Mark Blohp

The CRADA is amended by modifying Article I to change the non-Navy party company name and corporate headquarters address to Blackhawk-Geometrics, Inc., 301 Commercial Road, Suite B, Golden, CO 80401-5613 and to change the BGI Personnel in Article 6.2.2.

**98-201 (Amendment #2)****Boundary Element and Finite Element Models for the Application of Nearfield Acoustic Holography CRADA Between NRL and Automated Analysis Corporation (AAC)**

Original NRL Principal Investigator: Brian H. Houston, Code 7136

Original AAC Principal Investigator: Bryce Gardner

Original Funding: \$160,000

Original Duration: 24 months

Original Signed: 29 June 1998

The objective of this cooperative research is to develop and validate a robust algorithm to identify a noise source based on sound pressure measurements on a surface with an arbitrary shape.

**Second Amendment:**

Signed: 22 June 2000

Duration: Extended 6 months. Expires 29 December 2000

The CRADA is amended by modifying the duration in Article 14.2.

**98-211 (Amendment #2)****Structural Acoustics of Aircraft Interiors****CRADA Between NRL and Cessna Aircraft Company (CAC)**

Original NRL Principal Investigator: Brian Houston, Code 7136

Original CAC Principal Investigator: Robert Howes

Original Funding: \$120,000

Original Duration: 24 months

Original Signed: 12 August 1998

The objective of this CRADA is to carry out research toward the development of a structural acoustic model of aircraft interior acoustics with the ultimate goal of creating design guidance and tools for a quieter business jet.

**Second Amendment:**

Signed: 14 September 2000

Duration: 12 months. Expires 12 August 2001

The CRADA is amended by modifying the duration in Article 14.2.

**98-224 (Amendment #2 & #3)****Polymer Selection and Deposition Techniques For Resistive and Capacitive Mode Chemical Sensor Arrays****CRADA Between NRL and Cyrano Sciences, Inc. (CSI)**

Original NRL Principal Investigator: R. Andrew McGill, Code 6370

Original CSI Principal Investigator: Richard S. Payne

Original Funding: \$200,000

Original Duration: 12 months

Original Signed: 20 April 1999

The objective of this CRADA is to determine the optimum materials and deposition techniques for the fabrication of chemically sensitive resistor arrays with particular focus on the rapid detection of TNT.

**Second Amendment**

Signed: 24 April 2000

Duration: Extended 2 months. Expires 20 June 2000

The CRADA is amended by modifying the duration in Article 14.2.

**Third Amendment:**

Signed: 28 June 2000

Duration: Extended 2 months. Expires 20 August 2000

The CRADA is amended by modifying the duration in Article 14.2.

**99-231 (Amendment #1)****Inorganic-Organic Hybrid Polymers for Aircraft Engine Applications****CRADA Between NRL and United Technologies Corporation - Pratt & Whitney Division (UTC-P&W)**

Original NRL Principal Investigator: Teddy M. Keller, Code 6127

Original UTC-P&W Principal Investigator: Lisa Walla

Original Funding: \$75,000

Original Duration: 18 months

Original Signed: 30 March 1999

The objective of this cooperative research program is to synthesize, characterize and test the high temperature properties of a series of inorganic-organic hybrid polymers in order to assess their suitability for application in aircraft components that must withstand high temperatures. A further objective is to develop scaled-up synthesis, curing and molding procedures in anticipation of commercialization.

**First Amendment**

Signed: 31 August 2000

Duration: Extended 12 months. Expires 30 September 2001

UTC-P&W Principal Investigator: Charles Watson

The CRADA is amended by modifying the UTC-P&W Personnel in Article 6.2.2 and Article 13.2.6, the duration in Article 14.2 and the Statement of Work.

**99-241 (Amendment #1)****Blossom Point Dual Use Technology Study****CRADA Between NRL and AlliedSignal Technical Services Corporation (ATSC)**

Original NRL Principal Investigator: David Schrifman, Code 8140

Original ATSC Principal Investigator: Todd Probert

Original Funding: \$15,000

Original Duration: 4 months

Original Signed: 17 August 1999

The objectives of this CRADA are to study and report the feasibility of transferring ground station technology developed by NRL to ATSC and to compare the capabilities available at the BP facility with the requirements of a ground station in the DataLynx® network. The feasibility of sharing resources available at the NRL facility with a private company will also be determined.

**First Amendment**

Signed: 16 December 1999

Duration: Extended 6 months. Expires 17 June 2000

NRL Principal Investigator: Alan Sharman, Jr., Code 8140.5

The CRADA is amended by modifying the NRL Personnel in Article 6.2.1 and the duration in Article 14.2.

**99-244 (Amendment #1)****Nuclear Magnetic Resonance of Deep-Sea Gas Hydrate Formation****CRADA Between NRL and Monterey Bay Aquarium Research Institute (MBARI) and Schlumberger Technology Corporation (STC)**

Original NRL Principal Investigator: James Yesinowski, Code 6122

Original MBARI Principal Investigator: Peter Brewer

Original STC Principal Investigator: Robert Kleinberg

Original Funding: Each party will fund its own efforts

Original Duration: 12 months

Original Signed: 23 September 1999

The research has the following objectives: (1) To explore a fundamentally new approach using Nuclear Magnetic Resonance (NMR) to investigate gas hydrate formation over long durations in the marine environment; (2) To begin providing experimental results that can be used to assess the realism of theoretical models of hydrate formation based on considerations of fluid flow in porous media; (3) To gain experience for future possible applications from the first use of NMR in the deep-sea environment.

**First Amendment**

Signed: 6 June 2000

Duration: Extended 6 months. Expires 23 March 2001

The CRADA is amended by modifying the duration in Article 14.2.

**99-249 (Amendment #1)****Fiber-Optic Oil Well Sensors****CRADA Between NRL and Halliburton Energy Services, Inc. (HES)**

Original NRL Principal Investigator: Anthony Dandridge, Code 5670

Original HES Principal Investigator: John Dennis

Original Funding: \$100,000

Original Duration: 12 months

Original Signed: 15 July 1999

The objective of this CRADA is to develop a high-performance fiber optic sensor system for monitoring conditions in oil wells, particularly pressure and temperature.

**First Amendment:**

Signed: 26 July 2000

Duration: Extended 6 months. Expires 15 January 2001

The CRADA is amended by modifying the duration in Article 14.2.

**99-251 (Amendment #1 and #2)****Digital Emergency Medical Service Satellite Networking****CRADA Between NRL and The University of Texas Health Science Center at Houston (UTH)**

Original NRL Principal Investigator: Michael A. Rupar, Code 5554

Original UTH Principal Investigator: R. Douglas Tindall

Original Funding: \$100,000

Original Duration: 6 months

Original Signed: 5 August 1999



The objective of this CRADA is to develop a prototype satellite-networked system capable of two-way audio, video, and data communication between an ambulance and a hospital trauma center, and to test it in the Houston area with the Digital EMS network.

#### **First Amendment**

Signed: 23 February 2000

Duration: Extended 2 months. Expires 5 April 2000

The CRADA is amended by modifying the duration in Article 14.2.

#### **Second Amendment**

Signed: 30 March 2000

Funding: \$279,881

Duration: Extended 6 months. Expires 30 September 2000

The CRADA is amended by modifying the payment schedule in Article 8.1, the duration in Article 14.2 and the Statement of Work.

#### **99-253 (Amendment #1)**

##### **Displacement Damage Dose Analysis of the Radiation Response of Multi-Junction Space Solar Cells CRADA Between NRL and Lockheed Martin Missiles and Space (LMMS)**

Original NRL Principal Investigator: Robert Walters, Code 6825

Original LMMS Principal Investigator: George Pack

Original Funding: \$135,000

Original Duration: 7 months

Original Signed: 20 July 1999

The objective of this CRADA is to characterize the radiation response of state-of-the-art solar cell technologies and to provide damage analysis that can be used to both predict on-orbit performance and provide feedback for optimizing such performance.

#### **First Amendment**

Signed: 7 February 2000

Duration: Extended 2 months. Expires 20 April 2000

The CRADA is amended by modifying the duration in Article 14.2.

#### **99-255 (Amendment #1)**

##### **Ka-band Phased Array Antenna**

##### **CRADA Between NRL and Paratek Microwave, Inc. (PMI)**

NRL Principal Investigator: J.B.L. Rao, Code 5317

PMI Principal Investigator: Louise C. Sengupta

Funding: \$20,000; Phase I Option=\$30,000; Phase II Option=\$50,000

Duration: 12 months

Signed: 27 September 1999

The objective of this research is to demonstrate a phased array antenna that operates at Ka-band frequencies based on a voltage-tunable dielectric lens.

#### **First Amendment**

Signed: 25 September 2000

Duration: Extended 2 months. Expires 27 November 2000

The CRADA is amended by modifying the duration in Article 14.2.

**00-265 (Amendment #1)****Signal Processing for Fiber Optic Medical Sensors****CRADA Between NRL and Advanced Sensor Technology (AST)**

Original NRL Principal Investigator: Sandeep T. Vohra, Code 5673

Original AST Principal Investigator: Frank Bucholtz

Original Funding: \$60,000 for tasks 1-4 or \$53,000 for tasks 1,2, and 4

Original Duration: 6 months

Original Signed: 9 March 2000

The objective of this CRADA is to develop and test an electro-optical signal processor for use with a fiber optic sensor for medical applications. It is also an objective of this Agreement to transfer knowledge of the design and fabrication of electro-optical signal processors from NRL to AST.

**First Amendment**

Signed: 15 September 2000

NRL Principal Investigator: Michael Todd, Code 5673

Duration: 6 months. Expires 9 March 2000

Funding: Additional \$6,500. (Original pmt schedule revised. Total funded amount is now \$59,500)

The CRADA is amended by modifying the NRL Personnel in Article 6.2.1, the funding in Article 8.1, the duration in Article 14.2, and the Statement of Work in Appendix A. Additionally, Article 10.1.1. is modified to restrict AST's rights to any software developed by NRL under this Agreement.

**00-268 (Amendment #1)****Investigation of Increased Spontaneous Fission Rate of 235-U Under Acoustic Compression****CRADA Between NRL and JWK International Corporation (JWK)**

Original NRL Principal Investigator: Robert August, Code 6173

Original JWK Principal Investigator: Lawrence P.G. Forsley

Original Funding: Each party will fund its own efforts

Original Duration: 4 months

Original Signed: 27 April 2000

The objective of this CRADA is to verify the conditions of supercritical fission by monitoring the spontaneous fission rate of nearly pure 235-U in aqueous solution during cavitation. If an increase in the fission rate is observed, NRL and JWK will plan follow-on research and seek additional funding.

**First Amendment**

Signed: 11 August 2000

Duration: Extended 6 months. Expires 27 February 2001

The CRADA is amended by modifying the duration in Article 14.2.

**00-269 (Amendment #1)****Pulsed Laser Deposition of Ferroelectric Thin Films for Tunable Microwave Devices  
CRADA Between NRL and Paratek Microwave, Inc. (PMI)**

Original NRL Principal Investigator: James Horwitz, Code 6372

Original PMI Principal Investigator: Xubia Zhang

Original Funding: \$40,000

Original Duration: 9 months

Original Signed: 18 May 2000

The objective of this CRADA is to obtain a thin film material that exhibits a loss tangent of 0.004 at 10 GHz and a tunability of 30 percent for a 10-volt bias.

**First Amendment:**

Signed: 25 September 2000

Funding: \$3,000

The CRADA is amended by modifying the funding in Article 8.1 and the Statement of Work in Appendix A.

**00-272 (Amendment #1)****Apparatus and Procedure for Testing Fiber Optic Accelerometers****CRADA Between NRL and Litton Systems, Inc., Guidance & Control Systems Division (LGCS)**

Original NRL Principal Investigator: Gregory Nau, Code 5674

Original LGCS Principal Investigator: Linda Armijo

Original Funding: \$30,000

Original Duration: 2 months

Original Signed: 27 April 2000

The objective of this CRADA is to establish a low-cost system for testing fiber optic accelerometers at LGCS that ultimately will allow final calibration and qualification during the sensor manufacture process.

**First Amendment:**

Signed: 28 June 2000

Duration: Extended 1 month. Expires 23 July 2000

The CRADA is amended by modifying the duration in Article 14.2.

**00-276 (Amendment #1)****Development of Drug Compliance Chemical Detector****CRADA Between NRL and Nanosphere, Inc. (NI)**

Original NRL Principal Investigator: R. Andrew McGill, Code 6370

Original NI Principal Investigator: James D. Talton

Original Funding: \$30,000

Original Duration: 3 months

Original Signed: 22 June 2000

The objective of this CRADA is to develop and demonstrate a SAW sensor array detector that is capable of detecting by breath analysis specific pharmaceuticals or odorant taggants. If successful, a follow-on program will be developed.

**First Amendment:**

Signed: 5 September 2000

Duration: Extended 6 weeks. Expires 3 November 2000

The CRADA is amended by modifying the duration in Article 14.2.

**CRADAs TERMINATED OR EXPIRED****98-188 (Terminated 11 August 2000)****Germanium Strip Detector System for X-Ray and Gamma-Ray Spectrometry and Imaging  
CRADA Between NRL and Physical Sciences, Inc. (PSI)**

Original NRL Principal Investigator: Richard Kroeger, Code 7651.3

Original PSI Principal Investigator: Willi Schwarz

Original Funding: \$40,000

Original Duration: 30 months

Original Signed: 4 May 1998

The objectives of this cooperative research program are to: (1) Develop a 16 channel ASIC with multiplexed output and improved features from current NRL 2-channel chip set; (2) Demonstrate low noise, multi-channel readout of GSD using the new ASIC; (3) Develop new contact technology to replace Li diffused contacts on germanium strip detectors; (4) Demonstrate 0.5 mm pitch germanium strip detector; (5) Integrate germanium strip detector and new electronics into a demonstration system; (6) Conduct an assortment of tests to prove the utility of this technology to NASA and potential future sponsors and customers.

**98-221 (Terminated 30 May 2000)****Commercial Radiation-Tolerant Deep Submicron CMOS Microelectronics  
CRADA Between NRL and Mission Research Corporation (MRC)**

Original NRL Principal Investigator: Harold L. Hughes, Code 6816

Original MRC Principal Investigator: Scott Tyson

Original Funding: \$350,000 (\$166,667 was rec'd by NRL from MRC in FY99)

Original Duration: 34 months

Original Signed: 8 September 1998

The objectives of this CRADA are (1) To implement and optimize minimally invasive process and design methodologies to improve the radiation tolerance of commercial deep submicron CMOS microelectronics, including the preparation of test samples using these techniques; (2) To assess the scalability of these approaches to evolving CMOS technologies; (3) To perform total dose radiation effects testing on test structures, including capacitors, transistors, and circuits.

**Original First Amendment**

Signed: 7 September 1999

MRC Principal Investigator: Mary Dyson w/cc: Scot Fries

Funding: The funded level is reduced to reflect the reduction in tasking. The funded amount is now \$233,667.

The CRADA is amended by modifying the payment schedule in Article 8.1, to revise the reporting requirements in Article 9.2, to revise the point of contact and address for notices to MRC in Article 6.2.2 and Article 13.2.6, and the Statement of Work in Appendix A.

**99-239 (Terminated 27 October 1999)****DAMA/HF Waveform Development****CRADA Between NRL and Rockwell Collins Government Systems (RCGS)**

Original NRL Principal Investigator: Mark Powell, Code 8107

Original RCGS Principal Investigator: Michael Stelzl

Original Funding: \$100,000 (no funds received)

Original Duration: 24 months

Original Signed: 9 April 1999

This cooperative research program is aimed at three objectives. First, RCGS will develop two application programs that will run on the JCIT hardware. These application programs will give the JCIT the capability to emulate an ARC-220 and a SATCOM DAMA radio. This will give the Army additional waveform capabilities without having to make a significant capital investment.

Second, although RCGS has a number of experts who are familiar with the functions of ARC-220 and SATCOM DAMA radios, they are new to the area of software programmable radios. NRL will provide them a test bed and instruction on the operation and design of software programmable radios. This will significantly help them to develop a software programmable radio capability and get new products to the market.

Finally, by exposing RCGS to the JCIT architecture and infrastructure, NRL increases the possibility of a major radio vendor adopting the JCIT architecture and successfully transitioning the lessons learned from the A2C2S/JCIT development to industry.

**99-242 (Terminated 11 August 2000)****Advancing the Development of a YSI Microfluidic Sensor Platform****CRADA Between NRL and YSI, Inc.**

Original NRL Principal Investigators: R. Andrews McGill, Code 6370 and James Horwitz, Code 6372

Original YSI Principal Investigator: Barbara K. McQuiston

Original Funding: \$300,000 (received \$100,000 in FY99 and \$100,000 in FY00)

Original Duration: 21 months

Original Signed: 20 May 1999

The objective of this CRADA is to determine the optimum deposition techniques for the fabrication of a biosensing microfluidic platform with particular focus on a glucose sensing application.

**95-078 (Expired 4 January 2000)****Electronic Support Systems Technology****CRADA Between NRL and AIL Systems, Inc.**

Original NRL Principal Investigator: David Enders, Code 5726

Original AIL Principal Investigator: Ed Magill

Original Funding: Each party will fund its own efforts

Original Duration: 1 year

Original Signed: 4 January 1996

The objective of this CRADA is to conduct basic advanced receiver research and evaluate innovative concepts.

**Original First Amendment:**

Signed: 3 January 1996

Duration: 1 year. Extended to 4 January 1998

The CRADA is amended by modifying the duration in Article 14.2.

Original Second Amendment:

Signed: 16 March 1998

Duration: 1 year. Extend to 4 January 1999

The CRADA is amended by modifying the duration in Article 14.2.

Original Third Amendment

Signed: 1 April 1999

Duration: 1 year. Extended to 4 January 2000

The CRADA is amended by extending the duration in Article 14.2 and adding a task to the Statement of Work to accommodate the transfer of Secret level classified material for the purposes of accomplishing the work under the Agreement.

**96-108 (Expired 31 December 1999)****Magnicon Development at 11.4GHz****CRADA Between NRL and Omega-P, Inc. (O-PI)**

Original NRL Principal Investigator: Steven H. Gold, Code 6793

Original O-PI Principal Investigator: Jay L. Hirshfield

Original Funding: \$25,000

Original Signed: 10 July 1996

Original Duration: 24 months

The objective of the cooperative research is to conduct research on a high power, high gain, high efficiency X-band thermionic magnicon amplifier tube. The magnicon is an advanced scanning-beam microwave tube that was originally invented at the Institute for Nuclear Physics in the former Soviet Union. Specifically, the objective of this research is to develop a magnicon tube with a gain greater than 50 dB, a peak power of 50 MW at 11.4 GHz, a pulse length of 1  $\mu$ sec, and an efficiency of greater than 50%. This technology would have a variety of potential Navy and/or Department of Defense applications as a high efficiency replacement for klystron amplifiers in the frequency range of 0.5 to 12 GHz. The development of magnicon amplifier tubes integrates with other programs to develop advanced microwave sources for radars, remote sensing, and other applications. In addition, the advanced electron gun that will be developed as part of the program is an enabling technology for high power microwave tube development, and supports the development of klystrons, ubitrons, and linear beam devices, in addition to magnicons.

Original First Amendment

Signed: 30 October 1997

Funding: \$75,000

Duration: Extend termination date to 31 December 1999

The CRADA is amended by modifying the payment schedule in Article 8.1, the duration in 14.2 and the Statement of Work in Appendix A. The duration of the CRADA is extended from 10 July 1998 to December 1999. The payment schedule and the Statement of Work are modified to reflect the additional research to be conducted during the extended period of performance.

**97-155 (Expired 18 June 2000)****Development of Bi-Stable, High Resolution Reflective Display as a Memory Device****CRADA Between NRL and Opticom-ASA (O-ASA)**

Original NRL Principal Investigator: Ranganathan Shashidhar, Code 6950

Original O-ASA Principal Investigator: Per-Erik Nordal

Original Funding: \$250,000

Original Duration: 18 months

Original Signed: 18 September 1997

The objective of this CRADA is to develop and build a bi-stable, high resolution reflective display using conducting polymer based plastic substrates and further, to explore technical issues involved with a high definition electrical read and write memory device using a bi-stable cholesteric display and conducting polymer substrates.

First Amendment:

Signed: 17 August 1998

Funding: \$230,000

The CRADA is amended to modify the payment schedule in Article 8.1 and Statement of Work in Appendix A.

Second Amendment:

Signed: 10 February 1999

Funding: \$195,000

Duration: Extended 8 months. Expires 18 November 1999

The CRADA is amended to modify the payment schedule in Article 8.1, the duration in Article 14.2 and the Statement of Work in Appendix A.

Third Amendment

Signed: 3 December 1999

Funding: N/A - Payment schedule modified

Duration: Extended 7 months. Expires 18 June 2000

The CRADA is amended by modifying the payment schedule in Article 8.1, the duration in Article 14.2 and the Statement of Work.

Fourth Amendment

Signed: 7 February 2000

Company Name: Changed to Thin Film Electronics ASA (TFE)

TFE Principal Investigator: Changed to Johan Carlsson

The CRADA is amended by modifying Article I to change the name of the non-Navy party company name throughout the Agreement, the address to Thin Film Electronics ASA, Stoperigata 2, 0124 Oslo, Norway, and Article 6.2.2 to change the TFE Personnel to Johan Carlsson. Appendix C, containing the assignment of the CRADA by Opticom to TFE, is added.

**97-159 (Expired 19 February 2000)**

**Fiber Optic Seismic Systems**

**CRADA Between NRL and Optical Products, Inc. (OPI)**

Original NRL Principal Investigator: Anthony Dandridge, Code 5670.1

Original OPI Principal Investigator: Steven J. Maas

Original Funding: \$120,000

Original Duration: 12 months

Original Signed: 19 November 1997

The objective of this CRADA is to conduct basic studies and evaluate innovative concepts for fiber optic sensor systems for the marine exploration of oil and gas reserves. In particular, NRL has developed optical fiber technology for Navy towed array applications. The objective of this cooperative research is to develop and refine these fiber optic technologies for seismic applications.

First Amendment:

Signed: 29 September 1998

Duration: Extended 12 months. Expires 19 November 1999

The CRADA is amended by modifying the duration in Article 14.



Second Amendment:

Signed: 16 November 1999

Duration: Extended 3 months. Expires 19 February 2000

The CRADA is amended by modifying the duration in Article 14.2.

**97-160 (Expired 9 December 1999)****Conversational Case-Based Reasoning Research****CRADA Between NRL and Inference Corporation (IC)**

Original NRL Principal Investigator: David W. Aha, Code 5510

Original IC Principal Investigator: Ralph Barletta

Original Funding: \$50,000 for Phase I and \$50,000 for Phase II Option

Original Duration: 24 months

Original Signed: 9 December 1997

The objective of the cooperative research is to evaluate possible extensions to IC's product line of CBR tools based on automated case authoring and case retrieval models. Specific goals are (1) to simplify the case authoring process so that users can more easily design and maintain high performance case libraries in diverse domains and (2) to allow users to interact with probabilistic modeling tools so that they can improve the performance of case retrieval.

**98-169 (Expired 17 April 2000)****On-Line Fiber Bragg Grating Implementation****CRADA Between NRL and Spectran Specialty Optics Company (SSOC)**

Original NRL Principal Investigator: Charles Askins, Code 5612

Original SSOC Principal Investigator: Jim Clarkin

Original Funding: \$29,000 for Phase I, NRL Tasks 1 and 2 and NRL/SSOC Joint Tasks 1, 2, and 3; Phase I, Task 3 Option \$45,000; Phase II Start Option \$97,750; Phase II Finish Option \$68,500.

Original Duration: 24 months

Original Signed: 17 April 1998

The objective of this cooperative research program is to implement NRL's patented technology for producing fiber Bragg gratings in-line on the fiber draw tower in SSOC's Avon, CT facility. Under license from NRL, SSOC will manufacture and sell fiber Bragg grating arrays using NRL's patented technology.

First Amendment:

Signed: 18 May 1998

The CRADA is amended by modifying the SSOC Personnel in Article 6.2.2 and Article 13.2.6.

**98-177 (Expired 22 May 2000)****High Data Rate SATCOM Networks for Disadvantaged Users****CRADA Between NRL and Orion Network Services, Inc. (ONSI)**

Original NRL Principal Investigator: Tim Krout, Code 5550

Original ONSI Principal Investigator: David Codacovi

Original Funding: Each party will fund its own efforts

Original Duration: 24 months

Original Signed: 22 May 1998

The objective of this CRADA is to develop HDR SATCOM technology using VSAT to support network connectivity to small platforms (ships, aircraft, forward-deployed forces) and commercial installations where antenna size is a limiting factor. Additionally, bandwidth efficient modulations and efficient networking schemes will be developed to support efficient use of the satellite transponder asset.

**98-189 (Expired 9 October 1999)****Virtual Enterprise Endeavor****CRADA Between NRL and Husky Labs (HL)**

Original NRL Principal Investigator: Henry Ng, Code 5585

Original HL Principal Investigator: Gabriel Minton

Original Funding: Each party will fund its own efforts

Original Duration: 6 months

Original Signed: 9 April 1998

The objective of this CRADA is to provide a simple, easily enhanced medium which will allow NRL to acquire certain expertise in the development of the Virtual Enterprise capability for Navy programs. Utilizing NRL's experience with Navy requirements for Virtual Enterprise applications, and Husky Labs' experience with the Chakra product development, a customizable interface will be developed that is expected to ease information flow and decision-making in the coming century.

**First Amendment:**

Signed: 2 September 1998

Duration: Extended 12 months. Expires 9 October 1999

The CRADA is amended by modifying the duration in Article 14.2.

**NRL-98-190 (Expired 31 December 1999)****Improved Electronic Access to Journals Published by the American Institute of Physics****CRADA Between NRL and American Institute of Physics (AIP)**

Original NRL Principal Investigator: Rod Atkinson, Code 5220

Original AIP Principal Investigator: Tim Ingoldsby

Original Funding: \$58,147

Original Duration: 15 months

Original Signed: 14 October 1998

The objective of this CRADA is for NRL and AIP to work together to improve electronic access to AIP-published journals. AIP will provide to NRL a group of older AIP core archival and translation journals. NRL will digitize these journals by scanning their contents into high quality PDF files. The digitized versions of these older archival journals can be made available, for example on the Web, in an electronic format consistent with that of more recently published journals.

**First Amendment**

Signed: 22 October 1999

NRL Principal Investigator: James King

Duration: Extended 11 weeks. Expires 31 December 1999

The CRADA is amended by modifying the NRL Personnel in Article 6.2.1, and the duration in Article 14.2.

**98-192 (Expired 4 January 2000)****Multi-Channel Integrated Optic Phase Modulators****CRADA Between NRL and Dylor Corporation (DC)**

Original NRL Principal Investigator: William Burns, Code 5671

Original DC Principal Investigator: James Cole

Original Funding: \$150,000

Original Duration: 8 months

Original Signed: 4 May 1998

The objective of the cooperative research is to build an integrated optic device with multiple phase modulation channels, capable of independent broadband operation to ~20 GHz. In particular, the goal is fabrication of an 8-channel modulator where operation of all 8 channels (4 on each side of the chip) can be demonstrated. The prototype device demonstration will be considered a success if functional operation of 4 channels whose electrodes all terminate on one side of the chip can be demonstrated. This successful demonstration will likely lead to subsequent collaboration. A further objective is for NRL to transfer to Dylor Corporation the technology and information necessary for them to produce such devices commercially.

#### First Amendment

Signed: 21 December 1998

Duration: Extended 6 months. Expires 4 July 1999

The CRADA is amended to modify the duration in Article 14.2.

#### Second Amendment

Signed: 20 July 1999

Duration: Extended 6 months. Expires 4 January 2000.

The CRADA is amended to modify the duration Article 14.2.

#### **98-214 (Expired 12 August 2000)**

##### **Measurement and Analysis of the Radiation Response of InGaP/InGaAs Solar Cells in Terms of Displacement Damage Dose CRADA Between NRL and Essential Research, Inc. (ERI)**

Original NRL Principal Investigator: Robert Walters, Code 6615

Original ERI Principal Investigator: Linda Garverick

Original Funding: \$50,000

Original Duration: 24 months

Original Signed: 12 August 1998

The objective of this cooperative research program between NRL and ERI is to study the radiation response of ERI's innovative solar cell technology consisting of InGaP/InGaAs dual-junction semiconductor layers with bandgaps tailored to match the solar spectrum. In particular, the bottom InGaAs cell of the dual-junction technology will be investigated in-depth. The specific goal of this collaboration is to gain an understanding of the basic radiation response mechanisms for this new cell technology. The ultimate goal of the research is to develop high efficiency, radiation-hard solar cells that may be used in space-based systems such as those used in communications, navigation, environmental monitoring (oceanography, weather, topography), surveillance for over-the-horizon targeting support, tactical warning, and situational awareness/monitoring.

#### **98-224 (Expired 20 August 2000)**

##### **Polymer Selection and Deposition Techniques For Resistive and Capacitive Mode Chemical Sensor Arrays CRADA Between NRL and Cyrano Sciences, Inc. (CSI)**

Original NRL Principal Investigator: R. Andrew McGill, Code 6370

Original CSI Principal Investigator: Richard S. Payne

Original Funding: \$200,000

Original Duration: 12 months

Original Signed: 20 April 1999

The objective of this CRADA is to determine the optimum materials and deposition techniques for the fabrication of chemically sensitive resistor arrays with particular focus on the rapid detection of TNT.

First Amendment

Signed: 7 June 1999

The CRADA is amended by modifying the payment schedule in Article 8.1.

Second Amendment

Signed: 24 April 2000

Duration: Extended 2 months. Expires 20 June 2000

The CRADA is amended by modifying the duration in Article 14.2.

Third Amendment:

Signed: 28 June 2000

Duration: Extended 2 months. Expires 20 August 2000

The CRADA is amended by modifying the duration in Article 14.2.

**98-226 (Expired 9 December 1999)****Field Emitter Array Development for Power Grid Switching Applications****CRADA Between NRL and Diamond Microelectronics Corporation (DMC)**

Original NRL Principal Investigator: David S.Y. Hsu, Code 6170

Original DMC Principal Investigator: Ross James

Original Funding: \$50,000

Original Duration: 6 months

Original Signed: 9 November 1998

The major objectives of this cooperative research program are the following: (1) Demonstrate that the NRL vertical thin-film-edge FEA can be fabricated into a working device by using a high resistivity n-type silicon substrate; (2) Demonstrate 5 microamperes DC per cell from a small array of FEA cells; and (3) Demonstrate an emission area uniformity of 50% from a small array of FEA cells.

First Amendment

Signed: 14 June 1999

Duration: Extended 7 months. Expires 9 December 1999

The CRADA is amended by modifying the duration in Article 14.2.

**99-234 (Expired 13 April 2000)****Advanced Shipboard IR Decoy Development****CRADA Between NRL and Sippican, Inc. - Hycor Products Group (HYCOR)**

Original NRL Principal Investigator: F.J. Klemm, Code 5710

Original HYCOR Principal Investigator: Mike Gladwin

Original Funding: Each party will fund its own efforts

Original Duration: 12 months

Original Signed: 13 April 1999

The objectives of this cooperative research program are to: (1) Develop an advanced decoy to enhance the performance of a selected shipboard IR decoy, as mutually agreed between NRL and Sippican; (2) Develop alternate payload materials for IR decoys with the required spectral, temporal and intensity-time requirements; (3) Devise new payload deployment techniques; (4) Fabricate prototype hardware devices; and (5) Perform tests and evaluation of prototype hardware against current threats and possible future threat technologies.

**99-236 (Expired 20 April 2000)****Foreign Asset Exploitation Support  
CRADA Between NRL and Jaycor**

Original NRL Principal Investigator: Tim Andreadis, Code 6333

Original Jaycor Principal Investigator: James Wheeler

Original Funding: \$50,000 (revised by Amendment #1)

Original Duration: 12 months

Original Signed: 20 April 1999

The objective of this cooperative research program is for NRL and Jaycor to work together to develop electronic attack techniques to defend against threat assets.

**First Amendment**

Signed: 7 June 1999

Funding: Changed original payment of \$50,000 to \$48,130

The CRADA is amended by modifying the payment schedule in Article 8.1 to reflect shipping costs paid by NRL.

**99-241 (Expired 17 June 2000)****Blossom Point Dual Use Technology Study  
CRADA Between NRL and AlliedSignal Technical Services Corporation (ATSC)**

Original NRL Principal Investigator: David Schrifman, Code 8140

Original ATSC Principal Investigator: Todd Probert

Original Funding: \$15,000

Original Duration: 4 months

Original Signed: 17 August 1999

The objectives of this CRADA are to study and report the feasibility of transferring ground station technology developed by NRL to ATSC and to compare capabilities available at the Blossom Point facility with the requirements of a ground station in the DataLynx® network. The feasibility of sharing resources available at the NRL facility with a private company will also be determined.

**First Amendment**

Signed: 16 December 1999

Duration: Extended 6 months. Expires 17 June 2000

NRL Principal Investigator: Alan Sharman, Jr., Code 8140.5

The CRADA is amended by modifying the NRL Personnel in Article 6.2.1 and the duration in Article 14.2.

**99-243 (Expired 7 April 2000)****Vertical and Near-Vertical Alignment of Liquid Crystals  
CRADA Between NRL and SpatiaLight, Inc. (SI)**

Original NRL Principal Investigator: R. Shashidhar, Code 6950,

Original SI Principal Investigator: Scott Miles

Original Funding: Each party will fund its own efforts

Original Duration: 12 months

Original Signed: 7 April 1999

The objective of this CRADA is to develop and optimize a method for fabricating alignment layers with perpendicular or near-perpendicular orientation for liquid crystal displays.

**99-246 (Expired 28 September 2000)**

**Tripod Operators for Determining the Pose of Industrial Parts in Six Degrees of Freedom (6-DOF)  
CRADA Among NRL and the following non-Navy parties: Perceptron, Inc., The Ford Motor Company,  
Microdexterity Systems, Inc., and the National Center for Manufacturing Sciences, Inc.**

Original NRL Principal Investigator: Frank Pipiton, Code 5510

Original non-Navy Principal Investigator: Matthew Collins

Original Funding: \$125,000

Original Duration: 12 months

Original Signed: 28 September 1999

The objective of this CRADA is to develop software which can, using range data, estimate the pose in six degrees of freedom (6-DOF) of an industrial part with sufficient accuracy and speed to allow the successful and timely grasping of palletized parts during an automotive assembly operation.

**NRL-99-251 (Expired 30 September 2000)**

**Digital Emergency Medical Service Satellite Networking**

**CRADA Between NRL and The University of Texas Health Science Center at Houston (UTH)**

Original NRL Principal Investigator: Michael A. Rugar, Code 5554

Original UTH Principal Investigator: R. Douglas Tindall

Original Funding: \$100,000

Original Duration: 6 months

Original Signed: 5 August 1999

The objective of this CRADA is to develop a prototype satellite-networked system capable of two-way audio, video, and data communication between an ambulance and a hospital trauma center, and to test it in the Houston area with the Digital EMS network.

**First Amendment**

Signed: 23 February 2000

Duration: Extended 2 months. Expires 5 April 2000

The CRADA is amended by modifying the duration in Article 14.2.

**Second Amendment**

Signed: 30 March 2000

Funding: \$279,881

Duration: Expires 30 September 2000

The CRADA is amended by modifying the payment schedule in Article 8.1, the duration in Article 14.2 and the Statement of Work.

**NRL-99-253 (Expired 20 April 2000)**

**Displacement Damage Dose Analysis of the Radiation Response of Multi-Junction Space Solar Cells  
CRADA Between NRL and Lockheed Martin Missiles and Space (LMMS)**

Original NRL Principal Investigator: Robert Walters, Code 6825

Original LMMS Principal Investigator: George Pack

Original Funding: \$135,000

Original Duration: 7 months

Original Signed: 20 July 1999

The objective of this CRADA is to characterize the radiation response of state-of-the-art solar cell technologies and to provide damage analysis that can be used to both predict on-orbit performance and provide feedback for optimizing such performance.

First Amendment

Signed: 7 February 2000

Duration: Extended 2 months. Expires 20 April 2000

The CRADA is amended by modifying the duration in Article 14.2.

**00-258 (Expired 7 July 2000)**

**Ultrasonic Non-Destructive Evaluation of Above-Ground Storage Tanks  
CRADA Between NRL and Solex Robotics Systems (SRS)**

Original NRL Principal Investigator: Richard Mignogna, Code 6350

Original SRS Principal Investigator: Don Hartsell

Original Funding: \$14,000

Original Duration: 8 months

Original Signed: 7 November 1999

The objective of this CRADA is the ability of NRL's non-destructive evaluation system called Spectral Tracking to measure the thickness of above-ground storage tank bottoms and will be compared with that of SRS' ultrasonic time-of-flight system.

**00-262 (Expired 23 June 2000)**

**Effects of Electrode Conditioning on High Power Discharges in Flash X-Ray Diodes  
CRADA Between NRL and Ecopulse, Inc. (EPI)**

Original NRL Principal Investigator: Steven H. Gold, Code 6793

Original EPI Principal Investigator: Nino Pereira

Original Funding: \$10,000

Original Duration: 6 months

Original Signed: 23 December 1999

The objective of this CRADA is to investigate various methods to suppress diode collapse in flash X-ray diodes by controlling the electrode surface conditions.

**00-272 (Expired 23 July 2000)**

**Apparatus and Procedure for Testing Fiber Optic Accelerometers  
CRADA Between NRL and Litton Systems, Inc., Guidance & Control Systems Division (LGCS)**

Original NRL Principal Investigator: Gregory Nau, Code 5674

Original LGCS Principal Investigator: Linda Armijo

Original Funding: \$30,000

Original Duration: 2 months

Original Signed: 27 April 2000

The objective of this CRADA is to establish a low-cost system for testing fiber optic accelerometers at LGCS that ultimately will allow final calibration and qualification during the sensor manufacture process.

First Amendment:

Signed: 28 June 2000

Duration: Extended 1 month. Expires 23 July 2000

The CRADA is amended by modifying the duration in Article 14.2.

**SSC-95-006 (Expired 10 January 2000)****Marine Geophysical Systems****CRADA between NRL and C&C Technologies, Inc. (C&C)**

Original NRL Principal Investigator: Douglas N. Lambert, Code 7430

Original C&C Principal Investigator: Thomas S. Chance

Original Funding: \$5,000 (\$650 per person per day, or any part of a day)

Original Duration: 36 months

Original Signed: 10 January 1997

The objective of this cooperative research is to optimize geoscience software and instrumentation for naval mine countermeasure missions and for commercial applications related to the petroleum and telecommunications industries. Software and instrumentation will be made user-friendly to facilitate commercialization.

**SSC-96-001 (Expired 19 November 1999)****LOCUTUS Software Support****CRADA Between NRL and Fred Griswold Engineering, Inc. (FGEI)**

Original NRL Principal Investigator: Robert Delgado, Code 7183

Original FGEI Principal Investigator: Fred Griswold

Funding: Each party will fund its own efforts

Duration: 3 years

Signed: 19 November 1996

The objective of this CRADA is to develop a bug-free, accurate, user-friendly program with non-critical hardware demands. Each party will provide expert consultation and technical data to the other, with the intent to integrate the Local User Terminal Upgrade System (LOCUTUS) with a number of Local User Terminals (LUTs) that are tuned into the frequency of antennae or receiving dishes of Low Earth Orbit (LEO) satellites. If the cooperative R&D is successful, NRL-SSC will transition a Graphic User Interface (GUI) to the Naval fleet to enhance tactical operations through the manipulation of oceanographic and meteorological data on a real-time basis in a combat or exercise environment. FGEI intends to market LOCUTUS-based LUTs to university and Government scientists who acquire environmental data for LEO satellites, and to the commercial fishing industry.



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## Appendix C

### FY00 LICENSE REVIEW 1 October 1999 to 30 September 2000

#### **NEW LICENSES**

##### **NRL-LIC-99-8-069**

**GKN Westland Aerospace, Inc.**

Nonexclusive License - Signed 1 October 1999

Field of use: raw material and hardware manufacture for composite applications including aerospace, marine, missiles, space and transportation.

##### NRL Patents and Patent Application:

4,304,896	"Polyphthalocyanine Resins"
4,410,676	"Phenolic-Cured Phthalonitrile Resins"
4,619,986	"Epoxy Phthalonitrile Polymers"
5,003,039	"Amino Phenyl Containing Curing Agent for High Performance Phthalonitrile Resin"
5,208,318	"Phosphazene-Containing Amine as Curing Agent for Phthalonitrile-Base Polymer"
5,247,060	"Curing Phthalonitriles with Acid"
5,352,760	"Polymerization of Oligomeric Multiple Aromatic Ether-Containing Phthalonitriles"
5,389,441	"Phthalonitrile Prepolymer as High Temperature Sizing Material for Composite Fibers"
5,464,926	"Synthesis and Polymerization of Oligomeric Multiple Aromatic Ether Containing Phthalonitriles"
5,922,807	"Fiber-Reinforced Phthalonitrile Composite Cured With Low-Reactivity Aromatic Amine Curing Agent"
5,939,508	"High Temperature Epoxy-Phthalonitrile Blends"
09/007,826	"Phthalonitrile Prepolymerization Composition" filed January 15, 1998, for Navy Case No. 78,596

##### Inventors:

J.R. Griffith, Code 6120  
T.M. Keller, Code 6127  
S.B. Sastri, Code 6127

##### **NRL-LIC-99-15-076**

**OptoCom Innovation, S.A.R.L.**

Nonexclusive License - Signed 9 December 1999

Field of use: fiber amplifiers for optical communication, test and measurement instrumentation excluding instrumentation used for remote sensing, and lasers used for materials processing.

##### NRL Patent:

5,854,865 "Method and Apparatus for Side Pumping an Optical Fiber"

##### Inventor:

L. Goldberg, Code 5670.2

**NRL-LIC-99-7-068****Eikos, Inc.**

Nonexclusive License - Signed 26 July 2000

Field of use: manufacture and sales of phthalonitrile resins for test and evaluation by potential customers for composite applications including aerospace, marine, automotive, and grinding wheels.

**NRL Patents and Patent Application:**

4,619,986	"Epoxy Phthalonitrile Polymers"
5,003,039	"Amino Phenyl Containing Curing Agent for High Performance Phthalonitrile Resin"
5,247,060	"Curing Phthalonitriles with Acid"
5,939,508	"High Temperature Epoxy-Phthalonitrile Blends"
6,001,926	"Fiber-Reinforced Phthalonitrile Composite Cured With Low-Reactivity Aromatic Amine Curing Agent"
09/007,826	"Phthalonitrile Prepolymerization Composition" filed January 15, 1998, and allowed May 11, 1999 for Navy Case No. 78,596

**Inventors:**

T. M. Keller, Code 6127  
S. B. Sastri, Code 6127

**NRL-LIC-00-5-088****Nova Engineering, Inc. and University of Maryland (Co-Licensors)**

Nonexclusive License - Signed 16 August 2000

Field of use: wireless radio transceivers

**NRL Patent Applications:**

09/266,868	"Adaptive Routing Method for a Dynamic Network" filed March 12, 1999, by Co-Licensors for Navy Case No. 80,215
09/513,245	"A Method for Eliminating Synchronized Clocks in Distributed Routing Approaches that are Dependent on Temporal Ordering of Events" filed February 25, 2000, for Navy Case No. 80,244

**Inventors:**

V. D. Parks, Code 5523  
M. S. Corson, University of MD

**LICENSE MODIFICATIONS****NRL-LIC-99-8-069****GKN Westland Aerospace, Inc.**

Nonexclusive License - Signed 1 October 1999

1<sup>st</sup> Modification - Signed 28 February 2000

Field of use: raw material and hardware manufacture for composite applications including aerospace, marine, missiles, space and transportation.

The License was modified to reflect action taken by the U.S. Patent and Trademark Office changing U.S. Patent No. 5,922,807 issued July 13, 1999, to U.S. Patent No. 6,001,926 issued December 14, 1999.

**NRL Patents and Patent Application:**

4,304,896	"Polyphthalocyanine Resins"
4,410,676	"Phenolic-Cured Phthalonitrile Resins"
4,619,986	"Epoxy Phthalonitrile Polymers"
5,003,039	"Amino Phenyl Containing Curing Agent for High Performance Phthalonitrile Resin"
5,208,318	"Phosphazene-Containing Amine as Curing Agent for Phthalonitrile-Base Polymer"
5,247,060	"Curing Phthalonitriles with Acid"
5,352,760	"Polymerization of Oligomeric Multiple Aromatic Ether-Containing Phthalonitriles"
5,389,441	"Phthalonitrile Prepolymer as High Temperature Sizing Material for Composite Fibers"
5,464,926	"Synthesis and Polymerization of Oligomeric Multiple Aromatic Ether-Containing Phthalonitriles"
5,922,807	"Fiber-Reinforced Phthalonitrile Composite Cured with Low-Reactivity Aromatic Amine Curing Agent"
5,939,508	"High Temperature Epoxy-Phthalonitrile Blends"
09/007,826	"Phthalonitrile Prepolymerization Composition" filed 15 January 1998, for Navy Case No. 78,596

**Inventors:**

J.R. Griffith, Code 6120  
T.M. Keller, Code 6127  
S.B. Sastri, Code 6127

**NRL-LIC-95-001****Diamond Microelectronics Corporation**

Partially Exclusive License - Signed 23 February 1995

4<sup>th</sup> Modification - Signed 31 August 2000

Field of use: high performance diamond based electronic devices

The License was modified by adding two additional grounds for termination by Licensor to Article VIII, and by clarifying the notice by which Licensee may terminate this License.

**NRL Patents:**

5,269,890	"Electrochemical Process and Product Therefrom"
5,587,210	"Growing and Releasing Diamonds"

**Inventors:**

M J. Marchywka, Code 7662  
P.E. Pehrsson, Code 6174

**LICENSES TERMINATED****NRL-LIC-96-015****Rohm and Haas Company (formerly Shipley Company, L.L.C.) and Geo-Centers, Inc.**

Partially Exclusive License-Signed 29 June 1998

Field of use: liquid crystal display manufacturing

Terminated by Office of Naval Research for failure to make minimum annual royalty payments; termination letter dated 28 February 2000; termination effective 30 September 1998.

**NRL Patent and Patent Applications:**

5,578,351	"Liquid Crystal Composition and Alignment Layer"
08/559,318	"Liquid Crystal Composition and Alignment Layer"
78,467	U.S. Patent Application to be filed under the Patent Cooperation Treaty (PCT) application filed on July 24, 1997, (for which has been claimed the benefit of the filing date of U.S. Provisional Application Serial No. 60/022,588)

**Inventors:**

B.R. Ratna, Code 6930  
J.M. Schnur, Code 6900  
R. Shashidhar, Code 6950  
J.M. Calvert  
M.S. Chen  
R.J. Crawford  
B. Peek

## APPENDIX D

### REVIEW OF FY00 WORK FOR PRIVATE PARTIES 1 October 1999 to 30 September 2000

**Services Performed Under 10 U.S.C. § 2539b:**  
**(Provide testing to non-Federal parties)**

\$ 65,000	Test towed acoustic sensor rubber
\$ 10,000	Perform high-energy proton irradiation tests on 10 samples of microcircuit dual optocoupler
\$ 3,000	Test unpackaged CMOS devices with X-ray irradiation
\$ 4,000	Perform laser single event upset (SEU) tests using NRL's pulsed laser facility
\$ 72,000	Test proprietary test articles at NRL's Infrared Range Facility
\$ 772,400	Test elements of AEGIS Weapon System
\$ 30,000	Provide Infrared Range tests on purchaser supplied test article
\$ 950,000	Test DD-21 Navy Land Attack Destroyer ship design
\$ 240,000	Test DD-21 Navy Land Attack Destroyer ship design
\$ 10,000	Test data from thermal cycling tests of solar arrays
\$ 10,000	Test samples in NRL's Germanium Strip Detector system
\$ 50,000	Test radiation data provided by company on new multijunction solar cells
\$ 52,330	Test Coriolis Development Test Vehicle
\$ 8,000	Perform radiation test of single mode fiber
\$ 17,000	Perform irradiation tests of multijunction solar cells
\$ 4,000	Perform SEL tests using NRL's Pulsed Laser Facility
\$2,297,730	TOTAL ESTIMATED REIMBURSEMENT UNDER 10 U.S.C. §2539b

**Services Performed Under 10 U.S.C. § 2319:****(Satisfy a requirement for testing or other quality assurance demonstration that must be completed by an offeror before award of a contract)**

\$ 69,000	Perform MIL-SPEC testing for Aqueous Film Forming Foam (AFFF) to determine if it qualifies for the Qualified Products List
\$ 69,000	Perform MIL-SPEC testing for Aqueous Film Forming Foam (AFFF) to determine if it qualifies for the Qualified Products List
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\$138,000	TOTAL ESTIMATED REIMBURSEMENT UNDER 10 U.S.C. §2319

**Services Performed Under 10 U.S.C. § 246:****(In some transactions that are “de facto Economy Act Orders,” NRL has used this authority to quickly, efficiently and fairly enter into cooperative relationships with universities and other private sector entities with respect to the performance of research and development functions)**

\$ 9,969	Provide support with an electron spin resonance technique
\$450,000	Enable an encrypted data link from an afloat DD-21 Navy Land Attack Destroyer test platform to a shore station
\$ 68,000	Design, fabricate and characterize photonic crystal structures
\$ 9,643	Assist in the update of the Planetary Aerosol Monitor and Integrated Dust Analyzer instrument design and component specifications
\$ 24,005	Collaborate on and test a light modulator technique for fiber-optic sub marient communication
\$ 30,000	Perform basic research on natural gas hydrates
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\$591,617	TOTAL ESTIMATED REIMBURSEMENT UNDER 10 U.S.C. §246

REVIEWED AND APPROVED  
NRL/PU/1004—0—428  
November 2000

T. Coffey  
Director of Research

Approved for public release; distribution is unlimited